AN INVESTIGATION OF THE EFFECTS OF METAPHOR ON SEVENTH-GRADE STUDENTS' COMPREHENSION OF EXPOSITORY TEXT

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Abstract

This study investigated the effects of metaphor on children's comprehension of expository text. Forty-six seventh-grade students read either the metaphorical or the literal versions of two texts each containing eight targets, that is, metaphors or their equivalent literal phrases. One text, "Polar Bears," described a topic familiar to the students while the other, "Wombats," described an unfamiliar topic. After reading each text, students orally recalled as much information as possible, and then answered oral probe questions. Students who read the metaphoric versions of the texts also completed a written recognition-of-meaning test as an additional measure of metaphor comprehension.

There was no difference between students' comprehension of the metaphoric texts and their comprehension of the literal texts. There was, however, a facilitative effect for metaphor on students' comprehension of target information when the topic of the text was unfamiliar. Students were able to recall the information conveyed by the metaphors and to recognize the correct interpretations of the metaphors better from the unfamiliar text than from the familiar metaphoric text. Students' ability to answer factual questions based on the metaphors, however, was no different from the familiar text than it was from the unfamiliar text. This finding was interpreted as demonstrating an effect of a kind, for topic significantly affected the other measures of probed recall in favour of the familiar topic. The different findings of the free recall and

recognition-of-meaning measures, and the probe recall measures regarding target comprehension were likely due to the different task constraints of these sets of measures. It was noted that there is a need for further research on the relationship and nature of these widely-used measures of comprehension.

It was concluded that although metaphors appear with some frequency in basal readers, metaphor is not a troublesome aspect of language which children need to be taught to analyze and to interpret. If children are experiencing difficulties comprehending texts containing metaphors, they will likely benefit from curriculum activities designed to develop their vocabulary, their experience with language and literature, and their knowledge of the world.

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I. INTRODUCTION

1. STATEMENT OF THE PROBLEM

The present study examines the hypothesis that metaphor has a facilitative effect on reading comprehension. The specific purpose of this study is to examine the effects of metaphor on seventh grade-students' comprehension of expository texts with familiar and unfamiliar topics.

2. BACKGROUND OF THE PROBLEM

Since the time of Plato, scholars have speculated about metaphor as a linguistic and literary phenomenon (Anderson, 1964; Johnson, 1980), and various theories about its nature and function have both developed and been discarded. Nevertheless, the general view that metaphor is a special language form employed primarily for stylistic ornamentation, was common until quite recently (Campbell, 1975; Emig, 1972; Johnson & Malgady, 1980; Pollio, Barlow, Fine & Pollio, 1977). A somewhat different view of metaphor now generally prevails.

Since the 1970's, interest in figurative language has exploded; the importance of metaphor in language and thinking has been affirmed by philosophers, linguists, psychologists and educators (Honeck, 1980; Johnson & Malgady, 1980). Metaphor is now generally acknowledged as a pervasive aspect of natural language functioning, and one that may even be essential to cognitive functioning (Arter, 1976; Emig, 1972; Hoffman & Honeck, 1980; Johnson & Malgady, 1980; Ortony, 1980a; Pollio, Barlow, Fine & Pollio, 1977; Verbrugge & McCarrell, 1977).

Research in the various disciplines has centred on such

questions as: When, where and why do people use metaphor? When and how do they understand metaphor? How does the comprehension of metaphor relate to the comprehension of literal language? What insights does metaphor allow into the hypothesized connections between language and perception, and language and cognition? (Johnson & Malgady, 1980; Ortony, Reynolds & Arter, 1978; Pearson, Raphael, TePaske & Hyser, 1979; Pollio, Barlow, Fine & Pollio, 1977). Educators have focussed on (a) the development of children's abilities to deal with figurative language, and (b) the effects of metaphor in text on comprehension and learning. The present study centres on the second of these two foccuses, and investigates the notion that metaphor has "pedagogical" value for the reader. This notion derives from the assertion that metaphor acts as a bridging device between a known vehicle and an unknown topic. Proponents of this view (e.g., Ortony, 1975; Petrie, 1979) claim that metaphor can transfer knowledge from the known (the vehicle of the metaphor) to the new or unknown (the topic of the metaphor).

It was on this claim that Arter (1976) based her hypotheses that metaphor in instructional materials would increase interest, recall and comprehension for students of high and low verbal ability. She failed to find definitive support for her hypotheses, but found some evidence for a general facilitative effect on learning for the low verbal ability group. Arter's (1976) research motivated a set of studies by Pearson, Raphael, TePaske and Hyser (1979).

Pearson et al. (1979) conducted a series of three

experiments investigating the effects of metaphor and topic familiarity on the ability of third-graders, sixth-graders and undergraduates, to understand and remember text. They report three major findings which supported and extended Arter (1976). First, they found that children and adults' recall of metaphors was always as good as, and often better than, their recall of comparable literal paraphrases in situations where the vehicles of the metaphors were known by the subjects. Second, the role of metaphor as a bridging device appeared to depend upon passage familiarity; when passage content was familiar, metaphors were no more memorable than their literal counterparts, but when passage material was less familiar, metaphors seemed to assume greater memorability. Third, they found that metaphor effects appeared to be limited to their surface structure boundaries, because the target idea units containing metaphors did not elicit better recall of surrounding incidental idea units than did the target idea units containing only the literal equivalents.

The present study focuses on the second finding made by Pearson et al. (1979), that the role of metaphor as a bridging device appears to depend on passage familiarity. The need for further study of the effect of topic familiarity on the hypothesized facilitative effect of metaphor arises because of inconsistencies in the literature. While Arter (1976) found a general facilitative effect of metaphor on learning for low verbal ability students with a text that was unexpectedly somewhat familiar in topic to subjects, Pearson et al. (1979)

found significant effects for recall of metaphors only in their unfamiliar texts. Pearson et al. expressed some reservations about their judgements of familiarity, however, because the findings of the third experiment were inconsistent with the previous two experiments. There was unexpectedly no familiarity effect for the recall of incidental idea units or for intrusions into recall that were thematically consistent with the topics of the passage. Pearson et al. concluded that "....we have only begun to tap the surface of this familiarity issue"(p.16).

The present study modifies the methodology of Pearson et al. (1979), by applying it to a different population and new passages. The modifications consist of: (a) a prior-knowledge pre-test to measure subject's familiarity with text topics, and knowledge of the vehicles of the target metaphors embedded in the texts, and (b) a paraphrase recognition test (as recommended by Pearson et al.) to measure the comprehension of the target metaphors, used in addition to an oral free recall task and probed recall questions.

3. NEED FOR THE STUDY

Metaphor occurs with some frequency in basal readers (Arlin, 1978; Arter, 1976; Gambell & McFetridge, 1981; Valeri & Smith, 1983), and in children's literature (Winkeljohann, 1979). Although it has been suggested that figurative language can be a troublesome aspect of language with which students need help (Asch & Nerlove, 1960; Corbett, 1976; Cunningham, 1976; Emig, 1972; Gambell & McFetridge, 1981; Smith, 1973; Winkeljohann, 1979; and Winner, Rosentiel & Gardner, 1976), there are studies

which suggest that, under certain circumstances, metaphor may have a facilitative effect on comprehension and learning. If this is so, it is important that the factors involved in such facilitation be identified. Whether metaphor is of assistance or a hindrance, or both under varying circumstances, are questions which will be answered only by further research studies. There is a need for continuing systematic investigation into the effects of figurative language upon reading comprehension in ecologically valid settings, so that recommendations from a sound theoretical base can be made to publishers and writers of children's texts, and to teachers about curriculum experiences and specific teaching techniques that will enhance children's growing knowledge of language (Gambell & McFetridge, 1981; Miller, 1974). The present study has been designed to contribute to this process. Its purpose is to examine the effects of metaphor on seventh-grade students' comprehension of expository texts with familiar and unfamiliar topics.

4. RESEARCH HYPOTHESES

Following consideration of previous theory and research the following two classes of null hypotheses were made concerning: (1) the effect of metaphor, and (2) the effect of topic on metaphoric texts.

4.1 Effect Of Metaphor

This study proposes that there will be no difference between students' comprehension of texts containing metaphors and their comprehension of texts containing the literal equivalents of the metaphors. Specific hypotheses are as follows:

(1) Students' free recall of Target text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(2) Students' free recall of Incidental text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(3) The number of Evoked ideas present in students' free recalls of Metaphoric texts and the number in their recalls of Literal texts are not significantly different.

(4) Students' probed recall of Factual text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(5) Students' probed recall of Incidental Factual text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(6) The number of Inferences from targets in Metaphoric texts and the number from targets in Literal texts are not significantly different.

4.2 Effect Of Topic On Metaphoric Texts

This study proposes that there will be no difference between students' comprehension of the Familiar Metaphoric text and the Unfamiliar Metaphoric text. Specific hypotheses are as follows:

(1) Students' free recall of Target text information from Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

(2) Students' free recall of Incidental text information from the Familiar Metaphoric text and their recall from the Unfamiliar Metaphoric text are not significantly different.

(3) Students' free recall of Evoked idea units from Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

(4) Students' probed recall of Factual information from Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

(5) Students' probed recall of Incidental Factual text information from Familiar Metaphoric text and their recall from the Unfamiliar Metaphoric text are not significantly different.

(6) The number of Inferences from targets in Familiar Metaphoric texts and the number from targets in Unfamiliar Metaphoric texts are not significantly different.

(7) Students' recognition of the correct interpretations of Metaphor Targets from the Familiar Metaphoric text and their recognition of those from the Unfamiliar Metaphoric text are not significantly different.

5. DEFINITONS OF TERMS

The following definitions apply to terms used in this study:

5.1 Metaphor Terminology.

Metaphor - the application of a word or phrase that properly belongs to one context to a word or phrase in a different context in order to express meaning through some real or implied similarity in the referents involved (Anderson, 1964; Gambell & McFetridge, 1981). For example, in "The chairman plowed through the discussion" (Black,1962), the word "plowed" is used in a non-agricultural context to describe the chairman's "ruthless suppression of irrelevance and summary dismissal of objections"(p.30). Two disparate entities (the chairman's behaviour and plowing) have been compared on the basis of a shared attribute (thrusting down). For the purposes of the present study, the term metaphor has been used to refer to both similes and metaphors, for the two appear to share a common function as well as a common psychological process by which they are comprehended (Kintsch, 1974; and Ortony, 1979d)

Vehicle - the term being used metaphorically in a metaphor, for example "plowed" in "the chairman plowed through the discussion." The terminology developed by I. A. Richards in 1936 for the analysis of metaphors (Honeck & Hoffman, 1980) will be used in this study as it continues to be widely accepted, and has been used by many current researchers of metaphor (Ortony, Reynolds & Arter, 1978). Richards stated that a metaphor consists of two terms and the relationship between them. He called the subject term the topic or tenor, the term being used metaphorically the vehicle, the common relationship between the topic and the vehicle the ground , and the literal incompatibility of the two the tension (Honeck & Hoffman, 1980).

Prior Knowledge - subjects' knowledge of the topics of the experimental texts and the vehicles of the metaphors employed in the texts as measured by the Prior Knowledge Pretest.

Attribute - distinctive feature or essential quality of an object. For example, a distinctive feature of a polar bear is its white coat.

5.2 Experimental Text Terminology.

Expository Text - a passage of information written to instruct a reader concerning a certain object or idea.

Familiar Text - text about which subjects have written five or more appropriate attributes of the text's topic on the Prior Knowledge Pretest.

Unfamiliar Text - text about which subjects have written three or fewer appropriate attributes of the text's topic on the Prior Knowledge Pretest.

Metaphoric Texts - the versions of the familiar and the unfamiliar texts which contain target metaphors; in actual fact, the texts themselves are not metaphorical but merely contain metaphors.

Literal Texts - the versions of the familiar and the unfamiliar texts which contain the literal equivalent targets.

Metaphor Targets - metaphors embedded in the familiar and the unfamiliar experimental texts.

Literal Equivalent Targets - the literal phrases substituted in place of the metaphor targets in the literal version of both the familiar and the unfamiliar experimental texts.

5.3 Comprehension Terminology.

Comprehension - the process of understanding what has been read. This process requires the reader to reconstruct the author's intended message from the text, and to integrate this information with his knowledge and cognitive structures (Harris & Hodges, 1981). In this study, comprehension of both target and incidental text information will be investigated by means of Oral Free Recalls, Probed Recall Questions and Multiple-choice Metaphor Probes.

Recall - the process of bringing back from memory a representation of prior learning or experience by words (Harris & Hodges, 1981).

Oral Free Recall - a subject's unprompted oral retelling of a text just read.

Idea Unit - an individual idea which is expressed in a phrase or unit of language which seems to have a psychological significance, and which may be predicted from the linguistic structure of the text. A number of studies have suggested that information may be encoded and recalled in such units (Anglin & Miller, 1968; Fodor & Bever, 1965; N. Johnson, 1970).

Text Base Template - the list of idea units derived from a text using the methodology employed by N. Johnson (1970) and Meyer and McConkie (1973) in which a text is subjectively analyzed into what seem to be the individual ideas of the text.

Text Base Protocols - the list of idea units derived from a transcription of a subject's oral free recall of a text.

Target Recall - subjects' oral free recall of idea units

containing the targets, that is, the metaphors or their literal equivalent statements. Subjects' recall had to be an exact restatement or semantically entailed (adapted from Drum, 1978).

Incidental Recall - subjects' oral free recall of idea units other than the target idea units. The units must be exact restatements, or may include text specific elements put together in new ways, or additions of information that are semantically entailed by the text (adapted from Drum, 1978).

Evoked Recall - subjects' oral free recall of idea units which include elements of the text which are either inappropriate recombinations, or additions of information external to the text, or general statements that do not convey any specific information (adapted from Drum, 1978).

Probed Recall Questions - questions asked after the oral free recall task in order to identify additional information derived from the text which the reader may have stored in memory (Johnson, 1983).

Factual Probed Recall Questions - questions which focus on the factual information presented in the targets embedded in the experimental texts.

Incidental Factual Probed Recall Questions - questions which focus on the factual information presented in textual material in which the targets are embedded.

Inferential Probed Recall Questions - questions which require subjects to draw inferences from the factual information presented in the targets.

Multiple-choice Metaphor Probe - the short written multiple-choice recognition-of-meaning test designed as a supplementary measure of subjects' comprehension of the target metaphors.

6. ASSUMPTIONS

Two assumptions have been made based on the conditions of the study. First, the experimental texts are similar in nature and difficulty to those expository texts employed for instructional purposes in the classroom. Second, the readability measures used to assess the experimental texts give a close approximation of the degree of difficulty of the texts.

7. DELIMITATION OF THE STUDY

The study was conducted with a limited sample of a population of grade seven children from two adjacent schools in an urban school district. Thus care should be taken if the results are to be generalized to other populations, especially those which include children whose native language is not English.

Although the study employed texts derived from educational materials, the language samples are somewhat contrived in that eight "targets" have been embedded in each approximately 400 word text. Thus conclusions drawn on the specific language samples employed may not generalize easily beyond these samples to broader, more natural samples of language.

As the mode of discourse chosen for the experimental texts is expository, and the effects of metaphor may be different in other modes (for example, argument and narrative), it may not be possible to generalize findings beyond the chosen mode.

With regard to the metaphor targets themselves, the study investigated the response of children only to written metaphors of the "similarity" type (Billow, 1975). Thus it may not be possible to generalize the findings to other forms of metaphor.

II. REVIEW OF LITERATURE

Two major bodies of literature relevant to the present study will be reviewed: first, literature on major theories of metaphor, and second, research literature on children's abilities to use metaphor in language production and language comprehension. The former is warranted because one of the major criticisms of much of the metaphor research is that an adequate theoretical notion of what constitutes a metaphor is lacking. As to the second, although the purpose of this study is to examine the effects of metaphor on children's comprehension of expository text, studies examining the ability of children to produce metaphor have also been reviewed because an initial reading of the literature revealed an apparent paradox: that children seem to be able to produce metaphor at an early age, but are unable to comprehend metaphor until close to adolescence.

1. THEORIES OF METAPHOR

Since the 1970's there has been an explosion of interest in figurative language as educators, linguists, philosophers and psychologists have realized that metaphor plays a far more significant role in language and thinking than had previously been acknowledged (Honeck, 1980; Johnson & Malgady, 1980). Honeck (1980) describes a "flurry of activity" and suggests that it was caused in part by the change of emphasis within the psychological tradition from linguistic competence to communicative performance.

Three major theories of metaphor which have been proposed

over the centuries to explain the nature and function of metaphor and thought in language (Baldwin, Luce & Readance, 1982)--the Substitution theory, the Comparison theory, and the Interaction theory--illustrate the changing view of metaphor, and also reflect the language and focus of the different disciplines ranging from educational psychology to literary criticism (Arter, 1976).

1.1 The Substitution Theory

The Substitution theory of metaphor is the traditional view of metaphor. It asserts that a metaphor is a direct substitution of a non-literal phrase for a literal phrase that has exactly the same meaning (Ortony, Reynolds & Arter, 1978) for either of two reasons: lexical necessity (for example, coining a term for a new concept), or stylistic preference (for example, ornamental embellishment of a text) (Black, 1962). Metaphor is thus seen as important to communication. No cognitive significance is attached to its function.

The Substitution theory has been criticized for a number of reasons. Miller (1976) is critical of the use of metaphor for stylistic reasons, and claims that such metaphors are "..... often used in a misleading way to play upon the emotions or to carry an argument by means of distortion and overemphasis" (p.174). Verbrugge (1980) discusses three major inadequacies of the Substitution view of metaphor. First, Verbrugge (1980) states that the Substitution view treats metaphor as a form incapable of semantic precision; that is, a sentence containing a metaphor cannot mean what it "really" says. Second, Verbrugge

(1980) notes that the Substitution view underrates the degree of restraint on the content of a metaphor; that is, for a metaphor to be understood, the substituted or intruding word must elicit a high frequency associate of the surrounding context. Third, Verbrugge (1980) maintains that the Substitution view, in proposing only two uses for metaphor for the purposes of communication, seriously underrates the range of functions which a metaphor may serve. The Comparison theory of metaphor was proposed to overcome these limitations (Black, 1979).

1.2 Comparison Theories Of Metaphor.

The Comparison view of metaphor is regarded as a special case of the Substitution view (Black, 1979) and, like the Substitution view, does not attribute any cognitive significance to metaphor (Johnson, 1980). The Comparison theorists believe that a metaphor is an implicit comparison (Ortony, 1980a), or an elliptical simile (Black, 1962). They assert that the meaning of a metaphor is equivalent to a literal assertion of properties common to both the topic and the vehicle of the metaphor (Verbrugge, 1980). Black (1962) provides the following example: "The chairman plowed through the discussion," which involves the comparison of two disparate objects--the topic (the chairman's behaviour) and the vehicle (plowing)--on the basis of a shared attribute (thrusting down) to describe the chairman's "ruthless suppression of irrelevance and summary dismissal of objections" (p.30).

The earliest proponent of a Comparison theory of metaphor was Aristotle. One of his major contributions was his belief

that metaphor is constructed on the principles of analogy (Ortony, Reynolds & Arter, 1978). A later proponent, Breal (1897-1964), believed that metaphor is a basic component of language use and not a mere ornament as Aristotle believed. Breal's major contributions were his assertions that metaphor is a crucial vehicle for language change, and that there is an important difference between what he termed "novel" and "frozen" metaphors. Breal's thesis was expanded by Embler, who in 1966 suggested that metaphor is an essential transporter of meaning in language (Ortony, Reynolds & Arter, 1978). More current proponents of the Comparison view of metaphor include Campbell (1975) who sees metaphor as an implicit oxymoron, and Pollio, Barlow, Fine and Pollio (1977) who assert that metaphor is "a linguistic device which makes an explicit or implicit conjunction or comparison between two ideas; ideas that share some common, though often highly imaginative feature" (p.37).

The Comparison view of metaphor has engendered a wide variety of valuable psychological and linguistic models which have sought to explain the process involved in the comprehension of metaphor. Verbrugge (1980) presents three major types of models: the "featural models" (Leech, 1969; Malgady & Johnson, 1976; and Matthews, 1971) which propose mechanisms for detecting common features between pairs of terms or concepts; the "information processing models" (Sternberg, 1977) which describe a process of matching properties in the compared domains; and the "propositional models" (Kintsch, 1974; Mack, 1975; and Miller, 1979) which treat metaphor as a condensed assertion, and

require the reconstruction of the underlying proposition which was truncated on the way to the surface structure.

The Comparison view has been adopted by the majority of researchers investigating metaphor. Nonetheless, it has received criticism. Black (1962) states that the Comparison view "suffers from a vagueness that borders on vacuity" (p.37). Black believes that a metaphorical statement is not a substitute for a formal comparison, but has its own distinctive capacities and achievements. Similarly, Johnson (1980) asserts that since any two things are similar in some respects, the Comparison view can never explain what is interesting and important about metaphor. Still further support for this argument is given by Verbrugge (1980). He states that the Comparison approach fails to account for metaphors that "lead a comprehender to understand a topic in a novel fashion" (p.100).

Ortony (1980a) replies to some of these criticisms by stating that they are valid only in the face of a very naive version of the Comparison view. Ortony proposes a Modified Comparison theory which suggests a more cautious relationship between metaphors and comparisons.

Ortony (1980a) defines metaphor as "any contextually anomalous utterance, intended to be such by a speaker or writer, that has the characteristic that the tension (or conceptual incompatibility) is, in principle, eliminable" (p.352). Ortony (1980b) notes, however, that a metaphor is not just a linguistic entity, but more a general cognitive entity which could be entertained in thought, and need not necessarily be realized in

language. "It is not linguistic expressions themselves that are metaphors, but particular uses of them" (Ortony, 1979c, p.9).

With regard to comprehending metaphor, Ortony states that the making of comparisons is a component of the comprehension process, rather than the end result of the process (Ortony, Reynolds & Arter, 1978). Ortony (1979c) believes that interpreting metaphor involves recognition of a contextual anomaly, recognition that the anomaly is a nonliteral similarity statement, identification of matching attributes from the topic and vehicle, and finally, the identification of the salient attributes.

With regard to the role of metaphor in language, Ortony (1975) argues that metaphor is more than just a literary stylistic device. Ortony maintains that metaphor is an essential ingredient of communication, and consequently can be of great educational value. Ortony (1975) presents three important functions of metaphor to support this claim. The first, the Inexpressibility thesis, claims that metaphors are a means of expressing things that are not literally expressible; for example, new scientific conceptions do not necessarily come with ready made literal language to express them. The second, the Compactness thesis, claims that metaphors can transfer large "chunks" of information in cases for which either no literal equivalents are available or attempted literal equivalents would be tediously wordy; for example, "he dived into the icy water like a fearless warrior " conveys a host of attributes including bravery, strength, fearlessness, aggressiveness and

determination. The third, the Vividness thesis, claims that metaphors are particularly vivid or imageable "because of their proximity to, and parasitic utilization of perceived experience; by circumventing discretization, they enable the communication of ideas (emotive, sensory, and cognitive) with a richness of detail much less likely to come about in the normal course of events" (p.50).

Ortony (1975) claims these three functions give metaphor its great educational utility for two reasons. First, the vivid imagery resulting from metaphor comprehension encourages memorability, a more personal and insightful understanding, and therefore greater learnability. Second, metaphor can be used to supplement knowledge or to describe unfamiliar topics because metaphor allows a learner to move from the well known (the vehicle of the metaphor) to the unknown (the topic). For example, "The atom is a miniature solar system" (Petrie,1979) allows a student to come to a better understanding of the unknown topic (atom) by attributing to it characteristics of the known vehicle (the solar system).

1.3 The Interaction Theory

The Interaction theory was developed in response to the perceived weaknesses of the Comparison theory (Searle, 1979; Verbrugge, 1980). The approach, first proposed by I. A. Richards in 1936 (Black, 1979), seeks to demonstrate that metaphor is not only important in communication, but may also be essential to certain cognitive functions (Johnson, 1980). The Interaction view asserts that although metaphors can be

substitutes for literal statements, and can be comparisons between objects or ideas, the "psychologically interesting metaphors really involve more" (Ortony, Reynolds & Arter, 1978, p.923). A good metaphor can relate the thoughts present concerning two subjects in such a way as to produce a meaning that is new, and which transcends both (Arter, 1976).

Black (1962) explicates more clearly the ideas of Richards (Honeck, 1980). He maintains that a metaphor functions in the following manner. Both the topic ("principal subject") and the vehicle ("subsidiary subject") have systems of "associated implications," that is, commonplace cultural beliefs, personal attitudes, and unusual connotations established by the writer. The metaphor "selects, emphasizes, suppresses and organizes features of the principal subject by implying statements about it that normally apply to the subsidiary subject" (pp.44-45). Thus the metaphor acts like a filter, and creates a similarity which becomes an organizational framework or schema for developing new meanings (Honeck, 1980).

Other proponents of the Interaction view include Haynes (1975) who maintains that there are two different levels of metaphor not distinguishable grammatically: the comparison level and the interaction level; and Wheelwright (cited in Ortony, Reynolds & Arter, 1978) who similarly analyzed metaphor into two component types according to function: "epiphor" (expresses a similarity) and "diaphor" (produces a new meaning by juxtaposition).

Ortony, Reynolds & Arter (1978) argue, however, that

Interaction metaphors could be handled by the Comparison theory, and suggest that the "eureka" aspect referred to by Haynes (1975) to describe the new insights possible at the interactive level, "...may really be only the result of discovering what the real vehicle or topic of the metaphor is" (p.924). For example, in regard to the metaphor, "He dived into the icy water like a fearless warrior" (Ortony, 1975), the Comparison theory asserts that the reader will take all the aspects known to be peculiar to fearless warriors which could reasonably be applied to a diving swimmer (e.g., strength, resoluteness, courage etc.), and predicate the entire set of them to the swimmer. In contrast, the Interaction theory (Haynes, 1975) asserts that although this predication or transference of salient features does occur, what is more important is the feeling of "eureka"--the "click of comprehension that occurs after the comparison is made" (p.274)--which involves the formulating of "experimentally fertile hypotheses" based on the comparison. Ortony (1976) replies to Haynes' criticisms, and notes that the Interactive level is an aspect of comprehension not restricted to metaphor. Ortony contends that this process of making inferences extends to language comprehension in general, and to cognition as a whole. Ortony concludes that it is the process of comparison by which a metaphor is comprehended that is of central concern. Certainly, the Interaction view has not inspired as much experimental or theoretical work as the Comparison view has done (Verbrugge, 1980).

2. METAPHOR IN CHILDREN'S LANGUAGE PRODUCTION AND COMPREHENSION

In the recent explosion of interest in figurative language and its use, educators, linguists, philosophers and psychologists have asserted the importance of metaphor in language and thinking. Metaphor is now generally acknowledged to be a pervasive aspect of natural language functioning. Children's use of metaphor may be categorized as productive, that is, their use of metaphor in oral and written language, or receptive, that is, their ability to comprehend metaphor. While children are able to produce metaphor at an early age, it has seemed from much of the literature that they are unable to comprehend metaphor until close to adolescence. Recent research suggests, however, that children's ability to comprehend metaphor begins earlier than hitherto supposed, and that their success in comprehension is affected by a variety of factors such as reading ability, lexical development, general knowledge, exposure to literary conventions, contextual conditions including discourse type, topic and length, and more specifically, knowledge of the vehicle of a given metaphor.

2.1 Production

Studies of children's ability to produce metaphor have examined both oral and written language (Pollio & Pollio, 1974) and have compared use in language production with ability to comprehend (Gardner, Kircher, Winner & Perkins, 1974; Winner, Rosentiel & Gardner, 1976).

Pollio and Pollio (1974) were concerned with determining children's ability to use figurative language in oral and

written contexts. One hundred and seventy-four children in grades three, four and five were asked to complete three tasks. In the Composition task, the children wrote compositions on one of five given topics. It was found that children produced a greater number of frozen than novel figures, and that the absolute level of usage decreased over successive grades. In the Multiple-sentences task, the children wrote as many sentences as possible, using as many different meanings of that word as possible, for five single words (many of which were double-function terms used by Asch and Nerlove (1960)). It was found that children produced more frozen than novel figures, and that both showed a marked decrease over successive grades. In the Comparisons task, the children were presented with three word pairs and asked to provide orally, as many similarities as possible. It was found that figurative language production increased over successive grades, and that the children used more novel than frozen figures. The researchers stated that, taken as a whole, the results supplement the conclusions reached by Asch and Nerlove (1960) who investigated the developmental course of children's abilities to understand and explain metaphor (double-function terms). Pollio and Pollio concluded that children are able to use figurative language well before they can explain the exact nature of the relationship linking elements of a figure.

Gardner, Kircher, Winner and Perkins (1974) investigated the capacities of children (eighty-four at each of four age levels--7, 11, 14, and 19 years--and forty-seven preschool

children) to produce appropriate "metaphorical links," and to discriminate among metaphors of varying appropriateness, by having them (1) orally produce an ending, and (2) choose one of four endings to a series of eighteen very short incomplete stories presented orally. The results indicated a tendency, increasing with age, towards preference for an appropriate metaphor, which the researchers suggested may be attributed to "...increased cognitive sophistication, more intimate acquaintance with the literary medium, and a taste for materials which are less familiar and more interesting" (p.140). In contrast, however, conventional metaphors predominated in the subjects' oral productions, and appropriate metaphors were rarely produced by subjects of any age group. This, the researchers suspected, was due to "...some factor(s) in the developmental or educational process (which) militates against the production of original and metaphorical endings" (p.140).

Winner, Rosentiel and Gardner (1976) examined the ability of 180 children at six age levels (medians of 6, 7, 8, 10, 12 and 14 years) to produce, comprehend and explain metaphorical language. They postulated four levels of metaphorical comprehension related to age: magical (accepted at face value), metonymic (inappropriate juxtaposition of terms), primitive (focus on incidental aspects of the terms), and genuine (focus on the appropriate aspects of the terms). Subjects were asked to complete two tasks (a selection task, and a production or explication task) upon hearing simple sentences containing metaphors. The researchers contended that the results of both

tasks, in conjunction with the results of prior research, supported the hypothesized sequence of stages in the development of metaphor comprehension. The order of acquisition is: spontaneous production of metaphor, followed by comprehension, and finally by the ability to explain the rationale of a metaphor which requires a metalinguistic awareness that only emerges in preadolescence.

Ortony, Reynolds and Arter (1978) suggest, however, that the results do not necessarily establish that younger children cannot properly interpret metaphors. They note that in the selection task there may have been a response bias in favour of interpretations consistent with the kinds of stories children read, for it is common knowledge that as readers grow older, the nature of the texts they encounter changes. Specifically, young readers are exposed to a much higher proportion of fairy stories and "magical worlds" than are older readers. Thus it would be consistent with much of their experience for young children to select a magical interpretation of a given metaphor (Ortony, 1980a; Ortony, Reynolds & Arter, 1978).

The results of these studies suggest that children can spontaneously produce metaphors by preschool age (Winner, Rosentiel & Gardner, 1976), and that their oral productions and preference for novel metaphors increase with maturity (Gardner, Kircher, Winner & Perkins, 1974; Pollio & Pollio, 1974). These increases appear to parallel their growing cognitive sophistication and knowledge of the world and of literary conventions. In contrast, however, children's written

productions of metaphor seem to decrease in quantity with age; moreover, the majority of metaphors produced are frozen or conventional figures (Gardner, Kircher, Winner & Perkins, 1974; Pollio & Pollio, 1974).

2.2 Comprehension

In research studies examining children's ability to comprehend metaphor, metaphors have been presented either in minimal contexts, that is as single words or in short phrases and sentences, or in longer contexts, that is embedded within passages or texts. Length of context has been found to have a significant effect upon readers' comprehension of metaphor. Ortony, Schallert, Reynolds and Antos (1978) assert that, in general, figurative language is processed in much the same way as is literal language, and what determines the difficulty of processing is not nonliteralness but relatedness of context. Ortony et al. found that targets requiring a metaphorical interpretation under conditions of minimal contextual support took longer to be understood than those requiring literal interpretations, but that the difference disappeared when context length was increased. They suggest that, in the short context condition, fewer schemata can be activated so that a reader can generate only vague expectations which are insufficiently specific for a hypothesis/test process to be effective. Further support for this argument is offered by Osgood (1980) who states that young children's inability to comprehend brief metaphorical sentences may be explained in terms of "insufficient elaboration of the semantic features of

words and phrases" (p. 232). In view of the effect of context length, studies in this literature review have been categorized as either Short Context or Long Context.

2.2.1 Short Context Condition

One of the first systematic observations of the development of figurative language comprehension was a study by Asch and Nerlove (1960) who were interested in tracing the development of children's use and understanding of double-function terms; that is, terms which refer both to the physical properties of objects, and to the psychological properties of people, for example, hard, crooked, warm and sweet. The children, ranging in age from three to twelve years, were individually interviewed regarding the meaning of a limited number of double-function terms. The results indicated a regular developmental course, with children mastering the object reference of the double-function terms first. The children then acquired the psychological sense, independent of the object reference; that is, although the children understood the application of the terms to persons, they had great difficulty in formulating a connection with the physical meanings. They could not see the relation between the several meanings of a word. The dual property of the double-function terms was realized last, and then not spontaneously as a rule. The older children in the study were often not aware of the relations of the double-function terms, but once their attention was focused, they were quite capable of realizing them and explaining them.

A major criticism of this study is that although Asch and

Nerlove claim they were investigating metaphorical thinking, it could be argued that they were not, since the terms selected for investigation could all be classified as "frozen" metaphors (Pollio, Barlow, Fine & Pollio, 1977). If the terms were learned as separate lexical items by the children, one would expect the psychological meaning to develop later, as a matter of course. (Ortony, Reynolds & Arter, 1978). Accordingly, Ortony (1980a) maintains that the results could be explained in terms of an "impoverished understanding of the nature and subtleties of human personality traits" (p.353), and asserts that the study says no more about the ability of children to understand nonliteral uses of language than it does about their ability to understand literal uses. A second problem involved in interpreting Asch and Nerlove's results lies in the nature of the task used. The children were not asked to demonstrate their ability to produce or comprehend the double-function terms independent of their ability to explain them. It is widely accepted concerning language development that use precedes explication (Pollio, Barlow, Fine & Pollio, 1977), thus the inability of the younger children to analyze and explain their interpretations might have been expected.

Gardner (1974), who had noted the apparent contradiction between the ability of young children to use figurative language spontaneously, and research studies which asserted that metaphorical speech emerges only at a later age, sought to determine whether the ability to make metaphorical links could be found in preschool children. Gardner proposed that the

ability to project "sets of antonymous or 'polar' adjectives whose literal denotation within a domain (sensory modality or other coherent system) is known onto a domain where they are not ordinarily employed" (p.85) could be considered a demonstration of metaphorical capacity. Using adjectives, similar to Asch and Nerlove's (1960) double function terms (for example, hard-soft, warm-cold, loud-quiet, happy-sad, and light-dark), Gardner had one hundred and one children in four age groups (mean ages 3.5, 7, 11.5, and 19 years) match terms to cross-modal domains. That is, each pair of polar adjectives was to be matched by the subjects with a pair of elements drawn from the five domains; for example, the visual-abstract domain involved a choice of configurations of dense thick lines, and sparse thin lines, for loud-quiet, while the tactile domain involved a block of metal and a block of wood for cold-warm.

The findings of the study demonstrated that although there was a significant decrease in the number of errors made with increasing age--except that for the two oldest groups differences were almost nonexistent--the preschool children could make metaphorical associations as well as the adults could, provided the contents of the metaphors lay within their experience. Gardner concluded that the basic components of metaphorical thought have developed by the fourth year of life.

One problem with the study is that the experiment involved a forced-choice response between only two possible elements, which may have unduly affected the subjects' responses (Pollio, Barlow, Fine & Pollio, 1977). Second, the distinction of a

"right" or "wrong" metaphorical matching may not have been appropriate with such a range of subjects. "What may be a 'wrong' match for an adult may be a 'right' match for a child" (Pollio et al., 1977; p.165). Finally, as in the Asch and Nerlove (1960) study, the metaphors themselves involved frozen terms which may have been learned as vocabulary items. There is, therefore, a possible confounding between metaphorical capacity, and response to pre-established word associations (Ortony, Reynolds & Arter, 1978; Pollio et al., 1977).

Billow (1975) investigated the relationship between comprehension of metaphor and cognitive development as measured by two Piagetian tasks with fifty boys, aged five to thirteen, in individual interviews. The first phase of his investigation sought to determine whether there was a relationship between similarity metaphor comprehension and the achievement of concrete operations, that is, the ability to make classifications based on class inclusion. The children were required to tell the meaning of twelve sentences containing similarity metaphors, that is, ones which involved the comparison of two or more disparate objects or ideas on the basis of a shared attribute, for example, "Hair is spaghetti." The metaphors used, all entailed objects with tangible or relatively concrete qualities. The findings demonstrated that children as young as five years were able to interpret the similarity metaphors correctly.

The second phase of the investigation sought to determine whether there was a relationship between the comprehension of

proportional metaphors and proverbs and the achievement of formal operational reasoning, that is, the ability to make classifications based on proportionality. The subjects were required to tell the meaning of twelve sentences containing proportional metaphors and proverbs, and to complete a combinatorial reasoning task using four coloured circles. Billow classified proportional metaphors as those in which four or more elements are compared, not directly, but proportionally. For example, in "my head is an apple without any core", the "three stated elements must be complemented by an implied fourth to form the proportion: (head:apple):(brain:core)" (p.415). Billow found that better results on the combinatorial reasoning task were highly correlated with an ability to interpret the proportional metaphors, and that virtually no proverbs were solved before eleven years of age, a finding consistent with previous research. In conclusion, Billow stated that the results indicated that metaphor comprehension is a type of classificatory behaviour which is strongly related to maturing cognitive operations as well as to age. Billow concluded "that rudimentary forms of metaphor comprehension exist earlier in a child's life than hitherto supposed" (p.420).

A major problem with this study is that the metaphors used "vary along an uncontrolled but influential dimension, namely, existing knowledge pertaining to the concepts and relationships involved" (Ortony, 1980(a), p.354). Consequently, the results could probably be explained as well in terms of a world knowledge deficit as in terms of cognitive sophistication.

Second, Billow asked his subjects to perform a metalinguistic task, explication, in order to measure their comprehension. It is widely recognized that metalinguistic skills are as likely to be age and stage related as is figurative language comprehension itself (Ortony, Reynolds & Arter, 1978). Thus, Billow's findings must be interpreted with care.

Gentner (1977) proposed and examined an alternative approach to assessing children's development of metaphorical and analogical abilities. Her approach, which is based on an analysis of the mapping process underlying metaphor and analogy, focuses on subjects' abilities to preserve semantic relations as they map from the domain (a human body) to the range (a concrete object) on two tasks. The first, an orientation task, required the subjects to map six body parts (head, shoulders, arms, stomach, knees and feet) onto pictures of trees. The second, a local features task, required the subjects to map two face parts (eyes and mouth) onto pictures of mountains. In both tasks, the following question was asked orally of all subjects in an individual testing situation: "If this range object (e.g., tree) had a domain part (e.g., head), where would it be?" Gentner asserted that her results, which indicated that basic analogical ability is well developed in preschool children, weaken the position that young children lack metaphorical ability, and are compatible with the hypothesis that such ability is present at the outset of language use. Thus she concluded that basic analogical ability is well-developed in preschool children.

While the study has been cited as exemplary for avoiding many of the standard pitfalls of research in this area (for example, controls for vocabulary experience, background knowledge, and understanding of the task), and for placing little demand on children's metacognitive skills (Ortony, 1980a), it is not obvious that Gentner was investigating the capacity of children to comprehend metaphor. Gentner (1977) asserted that the distinction between metaphor and analogy is one of function, and stated that she was investigating an ability common to both analogical and metaphorical processing. Thus it can be said that the study was an investigation of metaphorical ability only in regard to its constituent analogical component (Ortony, Reynolds & Arter, 1978).

Arlin (1978) investigated two instructional intervention strategies in her exploration of metaphor and thought with one hundred and forty-two children in grades one to seven. After individual assessment of cognitive developmental level using nine Piagetian tasks, the students were randomly assigned to one of two instructional treatments within their operational level (classification training and direct metaphor comprehension training). The metaphors employed (representational, similarity and proportional) were all taken from the four major basal reading series currently in use for grades one to three in the Province of British Columbia, Canada. Students' metaphor comprehension abilities were measured before and after the intervention period in individual interviews and tasks. Arlin concluded that operational level as well as age is a strong

predictor of a child's ability to comprehend metaphors, and that given the limits of an operational level, both treatments were effective in producing increased metaphorical comprehension. Arlin's findings support those of Billow (1975).

Winner, Engel and Gardner (1980) describe previous research which indicates that although children use metaphoric language frequently, and seem to have rudimentary metaphoric capabilities even at a very early age, they exhibit considerable difficulty in comprehending linguistic metaphors. Thus they sought to investigate this difficulty further by determining whether misunderstanding of metaphor ought to be attributed to an inability to discover the ground of a metaphor, or to the task demands of a particular form of metaphoric sentence (predicative versus topicless metaphors), or to surface aspects of metaphoric sentences (predicative metaphors versus similes; topicless metaphors versus analogies and riddles). One hundred and twenty children at three age levels (six, seven and nine) listened to 15 sentences in an individual testing situation. Each sentence was presented in one of five linguistic forms: for example, the first sentence was presented either as a predicative metaphor (in which the listener must understand the ground) "The skywriting was a scar marking the sky," or as a topicless metaphor (in which the listener must discover the topic) "It was a scar marking the sky," or as a simile "The skywriting was like a scar marking the sky," or as a riddle "What is like a scar but marks the sky?" or as a quasi-analogy "A scar marks the skin and a ------- marks the sky?" All subjects received three

sentences expressed in each of the five forms. The subjects' comprehension was measured either by multiple-choice questions or by an explication task. Although not all their predictions were confirmed, the researchers state that the results of the study suggest that the task demands posed by predicative metaphors, and aspects of the surface forms in which topicless metaphors are encoded, pose obstacles to comprehension for children. Winner et al. concluded that although children recognize that the asserted equivalence of a metaphor based on grounds of physical resemblance is not to be taken literally, they do experience comprehension difficulties due to the unfamiliarity of the metaphoric form, the non-explicitness of the analogical comparison, and the analytic task of explicating the ground.

In contrast, Baldwin, Luce and Readance (1982) assert that it is not an ability to cope with the metaphoric form that causes comprehension difficulties for children; it is lack of knowledge. Baldwin et al. investigated the hypothesis that knowledge of the specific matching attribute is a precondition for the correct interpretation of a metaphor or simile, and based their study on the similarity theories of Tversky and Ortony (Ortony, 1979a). In two experiments, ninety-five fifth and sixth grade students were presented with metaphors and similes embedded in short sentences, and asked to write their interpretations of the figures and to list all the attributes of the vehicles that they could think of. In addition, in the second part of the first experiment, subjects were presented

with the figures which they had incorrectly interpreted, and asked to choose, from a given list of attributes, the attribute which was critical to understanding the metaphor or simile. It was found that there was a high correlation between subjects' ability to list important attributes and their ability to provide appropriate interpretations for metaphors and similes. Furthermore, attribute prompting significantly increased the number of appropriate interpretations. Baldwin et al. assert that the results of their experiments support the position that knowledge of the matching attribute is critical to the resolution of metaphors and similes, and that the implication of this assertion is that the interpretation of metaphor is sensitive to specific word knowledge. Consequently, Baldwin et al. conclude that instructional effectiveness may lie in increasing students' knowledge rather than in increasing their abilities to analyse and interpret language forms.

Gaus (1980) has criticized studies which investigate the comprehension of metaphor without a surrounding, supporting context. She suggests that the studies lack ecological validity, for figurative language is rarely encountered in isolation in either the real world or in classroom assignments. Nonetheless, the studies present consistent findings which serve as a valuable comparison with the studies of metaphor presented under longer contextual conditions.

The results of the studies suggest that children's metaphor comprehension abilities have begun to develop by preschool age (Billow, 1975; Gentner, 1977). These abilities then proceed on

a regular developmental course which seems to parallel children's increased world knowledge and cognitive sophistication (Arlin, 1978; Asch & Nerlove, 1960; Billow, 1975; and Gardner, 1974). Furthermore, children appear to recognize the non-literal nature of metaphor (Winner, Engel & Gardner, 1980), but do encounter difficulties interpreting metaphors when the content is beyond their experience, when critical attributes are not identified, when specific word knowledge is lacking, or when the comparison is not sufficiently explicit (Baldwin, Luce & Readance, 1982; Winner, Engel & Gardner, 1980). These conclusions support the assertion of Baldwin et al. that instructional effectiveness in metaphor comprehension may lie in increasing students' knowledge (lexical and world) rather than in increasing their abilities to analyze and interpret metaphor. This view certainly affirms the notion of Ortony (1980b) that metaphor is not merely a linguistic entity, but rather a particular use of language to express a cognitive entity.

The consistency of the findings of the above studies is probably due to three factors. First, the metaphor interpretation processes are not complicated by such text variables as discourse type and topic. Second, the metaphor targets employed in all the studies are relatively concrete. The shared attributes of each of these metaphors refer to tangible qualities or familiar actions and functions. Asch and Nerlove (1960) and Gardner (1974) used double-function adjectives such as warm, cold, and deep, and asked subjects to apply them to other domains, for example, human personality.

The remaining three studies used simple sentence targets in which the objects being compared were readily identifiable from the linguistic form of the metaphors, for example, "the athlete was like a cheetah" (Baldwin, Luce & Readance, 1982), "the pond is his mirror" (Billow, 1975), and "the raindrops were tears falling from the sky " (Winner, Engel & Gardner, 1980). Third, there is an uniform use of explication and/or matching tasks as the experimental measures.

2.2.2 Long Context Condition

Grindstaff and Muller (1975) reviewed and summarized the U.S. National Assessment of Educational Progress Reports (1970-71) on what young Americans know about literature. One aspect of the assessment consisted of determining the ability of subjects at four age levels (9, 13, 17 years, and young adult) to comprehend metaphor, which included the recognition of the topic and vehicle of specific metaphors. Results indicated a significant gain in comprehension ability up to age seventeen, with adults making no additional gains except in one category. The abilities of each age group to understand each metaphor were as follows: 47-76 percent of the nine-year olds, 56-82 percent of the thirteen-year olds and 68-90 percent of the seventeen-year olds. The gains were attributed to the success of school instruction in literature, as well as increased maturity and additional experience with literature.

Cunningham (1976) also used selections from children's literature to investigate the influence of the amount of metaphor in a text upon the reading comprehension of that text.

The subjects, one hundred and ninety sixth graders, read two 200-word passages which were identical except for the amount of metaphoric language. Although both passages yielded identical readability estimates, cloze comprehension of the metaphoric passage was significantly lower than comprehension of the non-metaphoric passage. Cunningham concluded that readability estimates do not account for a metaphoric passage being more difficult than a non-metaphoric passage, and therefore selections from children's literature may be generally more difficult than previously thought. However Gaus (1980) notes several problems with the study. First, the metaphoric passage is highly and unnaturally metaphoric, containing eighteen metaphors within the 200 word text, for example, "Well, Mother, when I danced into school this morning, Mrs. Day was pitching words with a man in the hall," is equivalent to "Well, Mother, when I got to school this morning, I saw Mrs. Day talking to a man in the hall." Second, asking children to complete an author's metaphors after a single reading of a text, in a cloze test, would hardly seem an appropriate measure of their ability to comprehend a text containing metaphors. Moreover, the construct validity of the cloze procedure as a measure of text comprehension is questionable.

Winkeljohann (1979) reached similar conclusions to those of Cunningham (1976) with regard to readability estimates and the difficulties posed by literature selections. She used sixty fifth-grade and sixty eighth-grade children to investigate the effects of metaphors in prose on reading comprehension.

Controlling for the limitations imposed by low mental ability, inability to respond to literature, and possible reading comprehension difficulties, Winkeljohann measured the subjects' ability to comprehend passages containing metaphor extracted from seven Newbery Award winning books by having them complete sets of multiple-choice paraphrase questions for each passage read. She concluded that metaphoric language is a hindrance in reading for fifth and sixth-grade students, that reading level as established by readability formulas is not a good indicator of reading difficulty, and that the understanding of prose containing metaphors appears to be a most complex interaction of thought and language.

It should be noted, however, that Winkeljohann used passages containing either three or four metaphors, one or two metaphors or no metaphors. She did not compare students' comprehension of the metaphorical and literal versions of the same passages, nor did she control for similarity of passage structure and prior knowledge of passage topics and metaphor vehicles. Thus it cannot be said that the study was an investigation of the extent to which metaphor in narrative material affects students' comprehension. Rather, the study is a general investigation as to whether there are factors inherent in the language of literature which can present comprehension difficulties to children.

Smith (1973) investigated and compared the understanding that forty sixth-grade and forty eighth-grade children obtained from reading passages containing metaphor. After being

presented with ten metaphors, each embedded in either a sentence or a short paragraph, subjects' understanding was measured by verbal retrospection, and by the Associated Commonplaces Test. This test was devised by the researcher based on Black's (1962) theory of metaphor. The test required subjects to select the appropriate commonplaces or associations for each metaphor from a given list of words. The National Council of Teachers of English (N.C.T.E.) Look at Literature test was also administered in order to test subjects' higher level critical reading abilities, to investigate whether the ability to understand metaphoric language is associated with higher level reading skills. A positive correlation was found between these two factors. It was also found that in general, simple, concrete, common and denotative metaphors were easier to understand than complex, abstract, unusual and connotative metaphors. In addition, a descriptive Piagetian analysis of subjects' responses to the metaphors indicated that the poorest responses were associated with concrete, global, diffuse and undifferentiated schema, and ego-centric or transductive thinking most commonly displayed by the younger children, while the best responses demonstrated flexible, abstract, differentiated schema, and contained examples of hypothetico-deductive reasoning and propositional thought. As expected, these responses were made, for the most part, by the older children.

Arter (1976) sought to ascertain whether or not metaphors in a text facilitate the comprehension and retention of the

material in the text, and increase readers' interest in the text. One hundred and forty-three sixth-grade pupils read a 570-word passage containing either ten metaphors or their equivalent literal translations. Using written free recalls, multiple-choice comprehension questions, and an interest rating, Arter found no difference in interest and no conclusive evidence suppporting the notion that the presence of metaphors in a passage facilitates learning. Arter noted, however, that several measurement and procedural problems were encountered. First, Arter's assumption that the "Sasquatch" would be an unfamiliar topic to her subjects proved incorrect. Second, Arter noted that the vehicles of the ten metaphors employed were not all well known to the subjects, and that this may have confounded the free recall results. Third, Arter noted that many of her subjects were unwilling to complete the tasks. Arter suggested that oral free recalls in an individual testing situation rather than written free recalls in a group situation, might have alleviated this problem. Despite these problems, she found that there was a general facilitative effect of metaphor for low verbal ability subjects which was consistent with previous research by Mayer (1975) who had found a significant effect of metaphor for low ability subjects in the learning of simple computer programming languages.

Arter's (1976) research motivated a set of studies by Pearson, Raphael, TePaske and Hyser (1979). They were impressed by Arter's finding that the metaphoric versions of passages were at least as comprehensible and memorable as the literal

passages, and they felt that if they used a different content, and metaphors with vehicles known to be familiar to the subjects, they could find support for Arter's original hypotheses. Using different passages, subjects at the third-grade, sixth-grade, and undergraduate levels, and oral rather than written free recalls, they found that across their three experiments there were patterns of regularity. First, they concluded that children and adult's recall of metaphor is always as good as, and often better than, their recall of comparable literal paraphrase in situations where the vehicle is within the subject's store of world knowledge. Second, the researchers noted that the role of metaphor as a bridging device appears to depend upon passage familiarity: when the passage material was familiar to subjects, the metaphors were no more memorable than their literal equivalents; but when the passage material was less familiar, metaphors were remembered better than their literal equivalents. They attributed this finding to the bridging function of metaphor hypothesized by Arter (1976) and Petrie (1979). Third, the researchers stated that the metaphors' effects were limited to surface structure boundaries. The metaphors appeared not to exhibit clustering capabilities for they failed to elicit greater recall of the surrounding text than the equivalent literal paraphrases.

Pearson et al., however, did experience some difficulties in their study. First, they did not find an expected familiarity effect for recall of incidental idea units in their third experiment, and subjects' ratings of the familiarity of

the topics was inconsistent. As a result, the researchers questioned the validity of their judgements about familiarity. Second, Pearson et al. noted some differences between the comprehension evidenced by probed recall and the comprehension evidenced by free recall measures; namely, while there were significant interaction effects between topic and version for the probed recall of metaphors, there were none for free recall. In addition, a "floor effect" was found for free recall of targets in the third experiment, due to poor student recall. They urge caution with regard to the sole use of free and probe recall tasks as measures of comprehension, and suggest that additional comprehension metrics such as a paraphrase recognition test be used in future studies.

Reynolds and Schwartz (1979) also investigated the question of whether or not metaphors help or hinder prose comprehension. Using eight short didactic passages with either literal or metaphorical summarizing statements, seventy-one college students as subjects, and written recall measures, they examined whether the figurative nature of metaphor enhances memory for the metaphor itself, and whether the inclusion of metaphor in prose enhances the comprehension of the information surrounding the metaphor. The results indicated increased memorability for passages with metaphoric conclusions. The concluding metaphors were recalled better than the equivalent literal sentences, and in contrast to the findings of Pearson, Raphael, TePaske & Hyser (1979), there was also an increase in memory for the contexts preceding the metaphors.

This contrasting finding may be attributable to several factors. First, Reynolds and Schwartz used college students rather than elementary school students as their subjects. Second, they used written rather than oral free recall measures. Third, they used passages with either metaphoric or literal conclusions rather than passages in which metaphors or their literal equivalents had been embedded. This position factor may be significant for several reasons. Firstly, a conclusion is of high structural importance in a text. Meyer (1975) summarizes the literature concerning the structural importance of idea units in memory of text and notes that of all the variables studied, the structure variable appears to be the most promising in predicting whether ideas in a passage will be well or poorly recalled. She notes that subjects' recall protocols tend to state information that closely corresponds to the total meaning of the passage (that is, units of high structural importance) and omit secondary themes and descriptions (that is, units of low structural importance). Concluding statements are thus likely to be well remembered, and also to carry with them a greater memory for preceding units of related important information. Thus it follows that a metaphor placed in a concluding statement is likely to be better remembered than a metaphor placed in a position of lower structural importance in a text.

The results of the studies investigating children's abilities to comprehend metaphors presented under long contextual conditions are inconsistent. Grindstaff and Muller

(1975) and Smith (1973) document a developmental growth in students' abilities to comprehend metaphor. Cunningham (1976) and Winkeljohann (1979) consider metaphoric language to be more difficult to comprehend than literal language. In contrast, however, Arter (1976), Pearson, Raphael, TePaske and Hyser (1979) and Reynolds and Schwartz (1979) note that metaphor is at least as comprehensible as its literal equivalent, and that under certain conditions metaphor may have a facilitative effect on passage comprehension. Several reasons are suggested for these inconsistent findings. First, the types of metaphor employed as targets vary greatly in form, naturalness and familiarity of content: for example, some are selected from children's literature ("...(she) watched the trees tossing in the frenzied lashing of the wind" (Winkeljohann, 1979)); others are contrived metaphors embedded in texts especially written for research purposes ("Mrs. Glass dried her hands on the tongue of her apron" (Cunningham, 1976)). Second, a wide variety of experimental tasks has been employed, some of which demand much more than mere comprehension of metaphor; for example, cloze exercises (Cunningham, 1976) require a knowledge of the author's literary style, multiple-choice questions (Smith, 1973; Winkeljohann, 1979) involve a cueing which can produce processing that might not otherwise have occurred, and written recalls (Arter, 1976) require well developed written production skills. Third, the texts in which the metaphors are embedded range over a variety of discourse types and topics, from passages extracted from Newbery Award winning children's books

(Winkeljohann, 1979), for example, through highly contrived and unnatural narrative passages (Cunningham, 1976) to short didactic texts (Reynolds & Schwartz, 1979).

Nonetheless, some tentative conclusions may be drawn from these results. First, as for metaphors presented in minimal contexts, it appears that children's abilities to deal with metaphor are present at an early age, and proceed on a regular developmental course which seems to parallel their growing maturity, cognitive development and experience with the world and with literature (Grindstaff & Muller, 1975). Second, children's abilities to deal with metaphor appear to be related to their general reading ability (Smith, 1973). Third, conventional readability formulas do not account for the reading difficulties that metaphor may impose (Cunningham, 1976; Winkeljohann, 1979). This conclusion is consistent with Ortony's assertion that metaphor is a functional rather than a grammatical language phenonmenon (Ortony, 1980b). Fourth, although Cunningham (1976) and Winkeljohann (1979)--using cloze and multiple-choice questions, respectively, as measures--concluded that metaphor can hinder the comprehension of prose, Reynolds & Schwartz (1979) using recall, and Arter (1976) and Pearson, Raphael, TePaske and Hyser (1979) using both comprehension questions and recall, found a range of facilitative effects: in the first place, the metaphoric versions of passages were at least as comprehensible and memorable as the literal versions. Secondly, the metaphoric versions of passages appeared to be more memorable than the

literal versions under certain conditions: when the text topic was unfamiliar (Pearson, Raphael, TePaske & Hyser, 1979); when the metaphors were concluding statements (Reynolds & Schwartz, 1979); and when subjects were of low ability (Arter, 1976). In the third place, metaphor effects were limited to their surface structure boundaries in one instance (Pearson, Raphael, TePaske & Hyser, 1979) but not in another (Reynolds & Schwartz, 1979).

3. SUMMARY AND CONSIDERATIONS OF THE PRESENT STUDY

With regard to theoretical background, a review of the literature revealed that a Comparative view of metaphor has been taken in the majority of the metaphor research studies. A Comparative view has also been taken for the purposes of this study. Metaphor has been regarded as a functional rather than as a grammatical language phenomenon, and one that relies on the surrounding context to signal to the reader that a metaphoric rather than a literal interpretation is required. Furthermore, the term metaphor has been used to refer to both similes and metaphors, for the two appear to share a common function as well as a common psychological process by which they are comprehended. Ortony (1979d) suggests that the function of both metaphor and simile is to express a similarity between referents that are not really alike for the purposes of communication. The shared comprehension process involves the realization of a tension or conceptual incompatibility between the referents which is solved by the identification of the shared attribute or attributes. A different but not entirely incompatible view has been proposed by Kintsch (1974) who suggests that the

comprehension of a metaphor proceeds by the conversion of the metaphor into a simile. Thus, the difference between metaphor and simile lies in the surface structural linguistic signals. A simile is usually indicated by the presence of such words as "like" or "as", while a metaphor relies primarily on the context in which it is embedded to force a metaphorical interpretation. For the purposes of this study which focuses on the comprehension processes, metaphor and simile have been regarded as one.

With regard to children's abilities to deal with metaphor, a review of the literature suggests that young children can and do comprehend metaphorical language provided the contents of the metaphors lie within their world experience. It also seems that young children can and do spontaneously use metaphorical language in their speech and, when task constraints are not overwhelming, can produce metaphors in their written language. It appears, however, that the ability to explain their own or others' metaphors requires a metalinguistic awareness that only comes with increased age, cognitive ability, and experience with the world and with language.

It also appears that although metaphor in text may present comprehension difficulties which are not indicated by readability measures, under certain conditions metaphor may actually facilitate the comprehension of a given text and the metaphors will be better remembered than their literal equivalents (that is, when the vehicle of the metaphor is known, when the topic of the given text is unfamiliar, and when the

concluding statement is metaphoric). Obviously, the effects of metaphor in text on recall and comprehension of both the metaphor and the surrounding text are not yet clear; nor does a sufficient body of evidence yet exist. Each of the above conditions was the finding of but a single study.

The present study, which extends the work of Arter (1976) and Pearson, Raphael, TePaske and Hyser (1979), was designed to further examine the conditions under which metaphor appears to have a facilitative effect on childrens' comprehension, that is, when the vehicle of the metaphor is known and the topic of the text is unfamiliar. Arter (1976) sought to ascertain whether or not metaphors in instructional texts increased interest in, and facilitated comprehension of the material in the texts. Although Arter failed to find definitive support for her hypotheses, she did find some evidence for a general facilitative effect of metaphor on learning for her low verbal ability students. Arter, however, encountered several measurement and procedural problems including an incorrect assumption concerning the "unfamiliarity" of the topic of the experimental passage, and her research motivated a set of studies by Pearson, Raphael, TePaske and Hyser (1979).

Pearson et al. investigated the effects of metaphor and topic familiarity on students' ability to understand and remember text. Pearson et al. reached three major conclusions which supported and extended Arter's hypotheses. First, children and adults' recall of metaphors was always as good as their recall of the equivalent literal phrases, in situations

where the vehicles of the metaphors were known by the subjects. Second, the role of metaphor as a facilitator of comprehension depended upon passage familiarity, that is, that metaphors were better remembered when the material in the text was unfamiliar. Third, metaphor effects appeared to be limited to their surface structure boundaries.

The present study focuses on the second finding by Pearson et al.--that the role of metaphor as a facilitator of comprehension depends on topic familiarity--because Pearson et al. expressed some reservations about their judgements of familiarity in light of inconsistencies among their three experiments. In their third experiment, Pearson et al. found, as predicted, significantly higher scores for the unfamiliar metaphoric passage than for the familiar metaphoric passage on probed recall questions. This difference was not found, however, on on the free recall measures. Furthermore,while the sixth-grade subjects in the third experiment consistently rated the unfamiliar passage as less familiar to them than the familiar passage, the third-grade students were evenly split as to the familiarity of the two passages. Thus, the present study modifies the methodology of Pearson et al. by employing a Prior Knowledge Pretest to ensure that text topics were Familiar and Unfamiliar to the subjects as required, and that vehicles of the metaphors were known to the subjects. In addition, a Metaphor Probe (a paraphrase recognition-of-meaning test) was administered as an additional comprehension measure. This additional measure was recommended by Pearson et al. as a result

of their conflicting findings from probe and free recall measures.

The review of literature also revealed a number of major problems which confront an investigator of the effects of metaphor on prose comprehension. The first is the problem of constructing metaphors which are novel (Ortony, Reynolds & Arter, 1978), and which can be paraphrased easily into literal statements to allow for a comparison between the metaphoric and the literal conditions (Reynolds & Schwartz, 1979). The literal equivalent statement must be a sentence containing words of equal frequency and it must be of equal syntactic complexity. The second is the problem of knowledge about the domains of information to which a metaphor relates (Ortony, 1980b; Pearson, Raphael, TePaske & Hyser, 1979; Reynolds & Schwartz, 1979). If a reader does not know about cotton candy, then an interpretation of "my head is like a ball of cotton candy" will be very difficult. The third is the problem of the experimental tasks employed to measure the comprehension of the metaphors. Emig (1972), Gaus (1980), Ortony, Reynolds and Arter (1978), and Pearson, Raphael, TePaske and Hyser (1979) note that the task demands of many of the experiments of metaphor comprehension are too complex, are not clearly understood by subjects, and are not closely related to the comprehension of metaphor. Johnston (1983) examined the constraints which operate in reading comprehension assessment, and he suggests that a variety of tasks is best as each task--oral free recall, probe comprehension questions and multiple-choice questions--provides

different yet complementary information about a reader's reading processes and final understanding. The fourth problem concerns subjects' response bias. Gardner, Kircher, Winner and Perkins (1974) suggest that elementary school children appear to have a preference for literal language even though they are cognitively capable of comprehending metaphor. Results may thus be confounded. These problems were considered carefully in the design and methodology of the present study.

III. DESIGN AND METHODOLOGY

The present study was designed and conducted to examine the effects of metaphor on children's comprehension of expository texts with familiar and unfamiliar topics.

1. SUBJECTS

The subjects for this study were forty-six grade seven students from lower, middle and upper socio-economic backgrounds, enrolled in two adjacent urban elementary schools in Richmond, British Columbia. Schools from School District No. 38 (Richmond) were chosen because of the district's interest in the present study. Two classes at James McKinney Elementary School and one class at William Bridge Elementary School were selected on the basis of their teachers' willingness to participate in the study when approached by the Elementary Language Arts Coordinator for the School District.

Forty-seven of the ninety-seven students enrolled in the three grade-seven classrooms were excluded for the following reasons: they failed to meet the criteria of the Prior Knowledge Pretest (described below), they were non-native English speakers, they scored below grade 6.0 on the reading subtest of the Canadian Test of Basic Skills (C.T.B.S.), or their C.T.B.S. scores were not available. The remaining fifty students were ranked according to their C.T.B.S. reading subtest scores. The students were then alternately assigned to read either the two Metaphoric or the two Literal versions of the Familiar and the Unfamiliar experimental texts.

During the experimental period a further three students

(one from the Literal condition and two from the Metaphoric condition) were absent for all or part of the testing. Thus, to balance the number of subjects in each condition for the final data analysis, a post hoc random exclusion of a Literal subject was made, leaving twenty-three subjects in the Metaphoric condition and twenty-three in the Literal condition.

2. THE EXPERIMENTAL TEXTS

Two versions, one Metaphoric and one Literal, of two short instructional expository texts were used as the experimental materials. One text, "Polar Bears," described a topic Familiar to the experimental population, while the other text, "Wombats," described an Unfamiliar topic. Both texts were adapted from supplementary educational materials, Hunted Mammals of the Sea by R. M. McClung (1978) and Australian Marsupials by P. Crowcroft (1970), which are likely to be found in a elementary school library.

The metaphoric version of each experimental text contained eight Metaphor Targets. For ease of description, these will be called the "metaphoric texts" although in fact the texts themselves were not metaphoric; they merely contained metaphors. The metaphors were constructed by a process of brainstorming, rating, rewriting and discussion by a group of six Language Educators and a graduate Composition class in the Language Education Department at the University of British Columbia. The metaphors finally selected for use in the eight target positions of the two experimental texts were judged, by a group of four Language Educators, to be the most natural and original, and the

best able to convey facts and engender inferences. The Literal versions of both the Familiar and the Unfamiliar texts were identical to the Metaphoric versions, except that eight literal phrases (Literal Equivalent Targets), rated by the Educators to be equivalent translations of the metaphors, had been substituted in place of the metaphors. For ease of description, these will be called the "literal texts." The texts and their targets are presented in Appendices A and B.

The four texts ranged in length from 378 to 401 words, and contained approximately the same number of idea units. The Familiar texts (Metaphoric and Literal versions) contained seventy-nine idea units, and the Unfamiliar texts (Metaphoric and Literal versions) contained seventy-two idea units. Each of the four texts has an estimated readability level of grade 7/8 as measured by the Dale-Chall Readability Formula (Dale & Chall, 1948). The Dale-Chall raw scores for each text are as follows: Familiar Metaphoric, 6.39; Familiar Literal, 6.00; Unfamiliar Metaphoric, 6.44; and Unfamiliar Literal, 6.28. A summary of the characteristics of the texts is presented in Table I below.

The topic of the Familiar text, "Polar Bears," was chosen because it was assumed that most Canadian children would be quite familiar with this animal. In contrast, the Unfamiliar topic, "Wombats," was chosen because it was assumed that very few Canadian children would have any knowledge of this Australian nocturnal marsupial. Furthermore, as a wombat is similar in some respects to a bear, it was assumed that it would be possible to keep the discourse structure of the two texts

relatively parallel. In practice, these assumptions proved correct. It may also be of interest to note that originally, the topics "Baseball" and "Cricket" had been chosen. However, these topics did not accommodate the embedding of "natural-sounding" metaphors--a persistent problem for the metaphor researcher.

Table I

Characteristics of the Experimental Texts

			Dale-Chall	
Text	Words	Idea Units	Raw Score	Readability
Familiar				
Metaphoric	399	79	6.39	Grade 7-8
Literal	400	79	6.00	Grade 7-8
Unfamiliar				
Metaphoric	388	72	6.44	Grade 7-8
Literal	375	72	6.28	Grade 7-8

3. THE MEASURING INSTRUMENTS

The following measuring instruments were used in the study: (1) Reading subtest scores on the Canadian Test of Basic Skills (C.T.B.S.), (2) Prior Knowledge Pretest, (3) Oral Free Recalls, (4) Probed Recall Questions, (5) Multiple-choice Metaphor Probe, and (6) Debriefing Interviews. All the instruments except for the C.T.B.S. reading subtest were pilot-tested two months prior to the experimental period.

3.1 The Canadian Test Of Basic Skills

The standardized reading test which was used to identify reading ability of subjects was the reading subtest of the Canadian Test of Basic Skills which was administered by the personnel of James McKinney School in June 1982, and by the personnel of William Bridge School in October 1982. Students' scores on the C.T.B.S. reading subtest were obtained from the students' cumulative record files. The scores were used for two reasons: (a) to ensure that there was a baseline reading ability level of grade 6.0 within the sample, and (b) to ensure that subjects assigned to the Metaphoric condition and those assigned to the Literal condition would be approximately equal with regard to measured reading ability. The mean reading ability of the Metaphoric subjects was grade 7.70 and the mean reading ability of the Literal subjects was grade 7.76.

3.2 Prior Knowledge Pretest

The prior knowledge pretest was a short written test which was designed to ensure that the text topics would be Familiar and Unfamiliar to the population as required, and that the vehicles of the metaphors lay within the subjects' store of world knowledge and vocabulary experience. See Appendix C for a copy of the test.

With regard to topic knowledge, subjects were required to write all they knew about each topic, Polar Bears and Wombats, in the form of short statements. Major category prompts (e.g., "appearance," "daily habits," "favorite food," "breeding pattern") were provided because it has been demonstrated that children have difficulty in getting access to and giving order to the knowledge that they have (Bereiter and Scardamalia, 1982).

With regard to vehicle knowledge, subjects completed a sixteen item multiple-choice test. Each metaphor vehicle was presented with a selection of four possible meanings. Subjects were required to choose and to circle the correct meaning for each vehicle.

3.3 Oral Free Recalls

The oral free recalls were the subjects' oral retellings, under unprompted conditions, of the texts which they had just read. Each subject's recall was taped, and later transcribed. See Appendix E for an example of an oral free recall protocol.

3.4 Probed Recall Questions

Probed Recall questions were asked in addition to the oral free recall task because it has been found that different comprehension assessments result from these two different measures due to differential task demands. Johnston (1983) notes that oral free recall of a text involves a large memory component and also problems of retrieval and production: for example, the reader must understand what level of detail must be reproduced, and to what degree the surface structure of the original text must be maintained. In contrast, probed recall questions are likely to tap more information and give a better indication of the extent to which a reader has transformed and integrated this information (Tierney & Cunningham, 1980), but the questions themselves can result in further processing of stored information. Furthermore, the information contained in one probe may affect a reader's performance on another probe (Johnston, 1983).

Subjects were asked three types of probed recall questions - Fact, Incidental Fact, and Inferential. Their answers were recorded on audiotape and transcribed for later analysis. The purpose of the Factual questions was to determine whether either version of a text (Metaphoric or Literal) differentially aided comprehension of the manipulated pairs. The purpose of the Incidental Factual questions was to determine whether either version of a text differentially aided comprehension of the incidental material. The purpose of the Inferential questions was to determine whether a greater number of valid inferences

could be made from metaphors than from their literal equivalents. The probed recall questions for each text are presented in Appendix F.

3.5 Multiple-choice Metaphor Probe

The multiple-choice metaphor probe was a sixteen item test which was designed as a supplementary measure of subjects' comprehension of target metaphors. See Appendix G for a copy of the test. This auxiliary measure was used because probed recall questions involved the metalinguistic task of explication in addition to the cognitive task of comprehension. In contrast, the metaphor probe is a simple recognition-of-meaning task. Pearson et al. (1979) suggested that the use of these two instruments in concert should constitute an appropriate methodology to investigate metaphor effect.

The probe was completed by those subjects who had read the metaphoric versions of the two experimental texts. The test consisted of the presentation of the sixteen target metaphors embedded in their contextual sentences. Each metaphor was supplied with a selection of four literal statements. Subjects were required to choose and to circle the correct literal paraphrase of each given metaphor.

3.6 Debriefing Interviews

The debriefing interviews provided an informal measure of subjects' ease of reading and understanding of the texts, familiarity with the topics, and interest in the topics. Each short structured interview was recorded on audiotape and later transcribed. The information so obtained served to clarify and

augment specific findings and suggested areas for further research. An interview schedule is presented in Appendix H.

3.7 Pilot Testing Of The Measuring Instruments

Two classes of grade-six students at a private boys' school in Vancouver, B.C., were used to pilot test the experimental texts and measuring instruments. Grade-six rather than grade-seven students were used for two reasons. First, the pilot population was readily available to the researcher. Second, the population was of average to very high reading ability and it was assumed that the grade level difference would be of little consequence. Both classes completed the Prior Knowledge Pretest, read the Metaphoric texts, and completed the multiple-choice Metaphor Probe. In addition, four individuals, two good readers and two average readers selected by the classroom teachers, read the Familiar and the Unfamiliar metaphoric texts, gave oral free recalls, and answered the oral comprehension questions. Responses to the measures by the classes and the individuals were examined, and items eliciting less than a 90 percent correct response were studied more closely, and discussed with two Language Educators. Examination of the pilot data resulted in four alterations to the measuring instruments: one pretest question, two oral comprehension questions and one metaphor probe question were re-worded in order to eliminate ambiguity.

4. THE EXPERIMENTAL PROCEDURE

The subjects were tested in April, 1983. One week prior to the experimentation period, the entire population's knowledge of both the topics of the two texts, and their knowledge of the vehicles of the metaphors used in the texts, were measured in a group administered Prior Knowledge Pretest. Then, as previously described, a number of students were excluded from the study. The remaining students were ranked according to their C.T.B.S. reading subtest scores and alternately assigned to read either the Metaphoric or the Literal versions of the two experimental texts. Each subject was also randomly assigned to read either the Familiar or the Unfamiliar text first in order to avoid a possible passage order effect.

Each subject was tested individually by the experimenter in a closed room. Uniform directions were given to each subject. The total testing time for each subject was between 25 and 35 minutes. The experimental period was almost three weeks in duration.

The subjects proceeded through the materials and measures in the order listed below. The approximate time spent on each procedure is indicated in parentheses.

Orientation to task and tester	(3 mins.)
Silent reading of the first text	(2 mins.)
Oral free recall	(3 mins.)
Oral probed recall questions	(2 mins.)
Multiple-choice metaphor probe - if applicable	(3 mins.)
Debriefing interview	(2 mins.)
Short break	(2 mins.)
Reorientation to task	(1 min.)
Silent reading of the second text	(2 mins.)
Oral free recall	(3 mins.)

Oral probed recall questions	(2 mins.)
Multiple-choice metaphor probe - if applicable	(3 mins.)
Final debriefing interview	(2 mins.)

Total testing time: 30 mins.

5. THE SCORING OF DATA.

Each of the five measuring instruments administered for this study (Prior Knowledge Pretests, Oral Free Recalls, Probed Recall Questions, Multiple-Choice Metaphor Probes, and Debriefing Interviews) was scored as described below.

5.1 Prior Knowledge Pretest.

Subjects were assigned three scores for this test: knowledge of Familiar topic, knowledge of Unfamiliar topic, and knowledge of the vehicles of the metaphors. First, subjects' written statements concerning the two topics were analyzed, and scores denoting the number of appropriate attributes written for each topic were assigned. A topic was deemed "Familiar" to a subject if five or more appropriate attributes were written, and "Unfamiliar" if three or fewer appropriate attributes were written. Second, subjects' responses to the multiple-choice test in which the correct meanings of the vehicles of the target metaphors were to be selected, were analyzed. A subject had to answer correctly at least twelve of the sixteen vehicles if he or she was to be included in the experimental sample. Those subjects who did not meet the criteria of the Prior Knowledge Pretest were excluded. The data were not used for further analysis.

5.2 Oral Free Recalls.

Scoring the data from the oral free recalls involved three steps: (a) constructing the text base templates, (b) analyzing the recall protocols into idea units and classifying these units, and (c) assigning scores to each protocol.

5.2.1 Construction Of The Text Base Template

The text base templates of the experimental texts were constructed by subjectively analyzing each text into a list of idea units, that is, words or phrases that seemed to convey the individual ideas stated in the text. An example of a text base template is presented in Appendix D. This procedure, similar to that developed by Johnson (1965) and subsequently employed by a number of researchers, including Meyer and McConkie (1975) and Arter (1976), was completed by four Language educators working independently on the metaphoric versions of the two experimental texts. The reliability of identifying idea units was measured by dividing the total number of actual agreements for the four judges by the total number of possible agreements. For example, the metaphoric Familiar text contained 397 words. Thus, there were 397 possible places where an idea unit boundary could be placed. Given four judges, there are six possible pairwise agreements for each boundary. Thus, the total possible opportunities for agreeement were 2382 (6 X 397). Similarly for the metaphoric Unfamiliar text; there were 378 words, and 2268 possible agreements. The four Language Educators agreed on 2263 placements for the Familiar text (i.e., 95 percent) and 2217 for the Unfamiliar text (i.e., 97.8 percent) giving an overall

agreement of 96.4 percent among four independent judges in identifying the idea units for the study. The boundaries were placed in all positions where at least three of the four judges agreed that a boundary should exist. The high percentage of agreement among the educators was not unexpected. Arter (1976) obtained 94 percent agreement among four independent judges in identifying the idea units of her metaphoric text, while Meyer and McConkie (1975) obtained 91.5 percent agreement among judges who were both identifying idea units and placing them into a logical hierarchy reflecting the structure of the given text.

5.2.2 Analysis And Classification Of The Protocols

Each recall protocol was analyzed into a list of idea units in the same manner that was employed for the construction of the text base templates. The list of recalled idea units was then compared with the appropriate text base template, and each idea unit classified as Incidental, Evoked, or Target (adapted from Drum, 1978). Incidental idea units were exact restatements of idea units plus semantically correct ideas which were not exact restatements, minus any target idea units recalled. Evoked idea units were inappropriate recombinations of text ideas, additions of information external to the text or general statements which did not convey any specific information. Target idea units were idea units containing either the metaphor targets or their literal equivalent statements in exact restatements or semantically equivalent statements.

5.2.3 Scoring The Protocols

Raw scores were assigned to each protocol for the Incidental, Evoked and Target idea units present. See Appendix E for an example of a scored oral free recall protocol. Inter-rater reliability between two independent judges, Language Educators, for a ten percent sample of protocols was calculated, and an agreement of 91.9 percent was obtained.

5.3 Probed Recall Questions.

Each subjects' answers to the probed recall questions were transcribed from the audio-tape recording and analyzed. Correct raw scores for each of the six Fact, six Incidental Fact, and six Inferential questions were tabulated and used in the analysis of data. Interrater reliability between two independent judges, Language Educators, for a ten percent sample of probe recall protocols was calculated, and an agreement of 96 percent was obtained.

5.4 Multiple-choice Metaphor Probes.

Raw scores were tabulated for subjects' correct responses to the multiple-choice metaphor paraphrase tests. These data were not included in the analysis because the results reflected the subjects' individual comprehension scores, and did not appear to provide any additional information. The results are, however, described in the findings of the study.

5.5 Debriefing Interviews.

Transcriptions of subjects' interviews were read, and an informal, introspective evaluation of the information was made.

6. THE ANALYSIS OF DATA

The data yielded scores on two sets of dependent variables: (a) Oral Free Recall (Incidental, Target, and Evoked) and (b) Probed Recall (Factual, Incidental Factual, and Inferential). Each set of dependent variables, Oral Free Recall and Probed Recall, was analyzed in a separate analysis of variance (ANOVA) with a covariate, in a (2) X (2) X (3) extended factorial design with repeated measures on the third factor. The between-subjects factor was Version (Metaphoric or Literal) and the within-subjects factor was Topic (Familiar and Unfamiliar). C.T.B.S. reading subtest scores were the covariate. There were twenty-three subjects in each Version by Topic cell. Results were tested for significance at the .05 level. Each set of dependent variables, Oral Free Recall and Probed Recall, was also analyzed in a one-way fixed effects multivariate analysis of variance (MANOVA) to corroborate and clarify the findings of the ANOVAs. Results were tested for significance at the .05 level.

IV. ANALYSIS AND RESULTS

The purpose of this study was to examine the effects of metaphor on seventh-grade students' comprehension of expository texts with familiar and unfamiliar topics. Two sets of dependent variables were analyzed--one set from Oral Free Recalls (Incidental, Evoked and Target) and one set from Probed Recalls (Fact Incidental Fact, and Inferential). Raw scores for each of the six dependent variables were transformed into proportional scores because of the different metrics involved: for example, in the Oral Free Recalls there were eight Target idea units and seventy-one Familiar or sixty-four Unfamiliar Incidental idea units to be recalled from each text, and in the Probed Recalls there were six Fact, six Incidental Fact and three Inferential questions to be answered for each text. The proportional scores were then transformed into radians by means of the arcsine transformation (Winer, 1971) in order to stabilize the variances and to preclude any systematic relationship between the means and the variances.

Each set of dependent variables, Oral Free Recall and Probed Recall, was analyzed in a separate analysis of variance (ANOVA) in a 2(Version) X 2(Topic) X 3(Dependent Variables) extended factorial design with repeated measures on the third factor. The BMDP:2V.7 statistical program (Dixon, 1983) was used for the analyses. The covariate, CTBS Reading Subtest scores, proved to be significant: Oral Free Recall - F (1,43) = 8.58, $p < .05$, and Probed Recall - F (1,43) = 11.81, $p < .05$. Adjusted cell means were therefore used in the interpretation of

results. The between-subjects factor was Version (Metaphoric or Literal) and the within-subjects factor was Topic (Familiar and Unfamiliar). There were twenty-three subjects in each Version by Topic cell. Results were tested for significance at the .05 level. Results of the ANOVAs on the two sets of dependent variables are presented in Tables III and IV in Appendix I.

Each set of dependent variables, Oral Free Recall and Probed Recall, was also analyzed in a one-way fixed effects multivariate analysis of variance (MANOVA) using the UBC:SPSS MANOVA statistical program (Lai, 1983). These further analyses were conducted to corroborate and clarify the findings of the ANOVAs. For both analyses, the between-subjects factor was Version (Metaphoric or Literal) and the within-subjects factor was Topic (Familiar and Unfamiliar). CTBS Reading Subtest scores were the covariate. There were twenty-three subjects in each Version by Topic cell. Results were tested for significance at the .05 level. Results of the MANOVAs on the two sets of dependent variables are presented in Tables V to X inclusive in Appendix I.

Two sets of research hypotheses were tested in the study--one set dealing with the effects of Metaphor on the comprehension of text, and the other with the effects of Topic on the comprehension of Metaphoric texts. Accordingly, the findings of the study are reported under the following headings:

1. Effect of Metaphor
2. Effect of Topic on Metaphoric Texts

1. EFFECT OF METAPHOR

The null hypothesis examined in this study is as follows: there will be no difference between students' comprehension of texts containing metaphors and their comprehension of texts containing the literal equivalents of the metaphors. Specific hypotheses were formulated for Oral Free Recall and for Probed Recall. The three null hypotheses relative to Oral Free Recall are as follows:

(1) Students' free recall of Target text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(2) Students' free recall of Incidental text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(3) The number of Evoked ideas present in students' free recall of Metaphoric texts and the number in their recall of Literal texts are not significantly different.

The ANOVA of the three Oral Free Recall variables (Target, Incidental and Evoked) revealed no significant main effect for Version (Metaphoric or Literal), F (1,43) = 1.07, $p > .05$. Results of the ANOVA are presented in Table III in Appendix I. Similar findings were noted in the MANOVA in which no significant main effect for Version was found on any of the variables. These results are presented in Tables V, VI and VII in Appendix I. Null hypotheses 1, 2 and 3 regarding the difference between students' Oral Free Recall of Target, Incidental and Evoked idea units from texts containing metaphors

and from texts containing the literal equivalents of the metaphors were accepted.

The findings in regard to Target recall, however, were interpreted with caution. Although the main effect for Version was not statistically significant, there was a significant two-way interaction between Version and Topic, $T = -3.17930$, $p < .05$, which indicates that Version had different effects on on Target recall depending on the Topic of the text. These results are presented in Table VII in Appendix I, and are discussed under Effect of Topic on Metaphoric Texts.

Three null hypotheses relating to Probed Recall were also formulated. They are as follows:

(4) Students' probed recall of Factual target text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(5) Students' probed recall of Incidental Factual text information from Metaphoric texts and their recall from Literal texts are not significantly different.

(6) The number of Inferences from targets in Metaphoric texts and the number from targets in Literal texts are not significantly different.

The ANOVA of the three Probed Recall variables revealed no significant main effect for Version, $F(1,43) = 0.98$, $p > .05$. These results are presented in Table IV in Appendix I. Similarly, the MANOVA revealed no significant main effect for Version on any of the variables. These results are presented in Tables VIII, IX and X in Appendix I. Hypotheses 4, 5 and 6

regarding the difference between students' Probed Recall of Factual, Incidental Factual and Inferential information from texts containing metaphors and from texts containing the literal equivalents of the metaphors were accepted.

The findings in regard to Incidental Factual Probed Recall, however, were interpreted with caution. Although the main effect for Version was not statistically significant, there was a significant two-way interaction between Version and Topic, $T = 2.13237$, $p < .05$, which indicates that Version had different effects on Incidental Factual recall depending on the Topic of the text. These results are presented in Table IX in Appendix I and are discussed under Effect of Topic on Metaphoric Texts.

2. EFFECT OF TOPIC ON METAPHORIC TEXTS

This study proposed that there would be no significant difference between students' comprehension of the Familiar Metaphoric text and their comprehension of the Unfamiliar Metaphoric text. Specific hypotheses were formulated for Oral Free Recall, for Probed Recall and for the Metaphor Probe. The three null hypotheses relative to Oral Free Recall are as follows:

(1) Students' free recall of Target text information from Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

(2) Students' free recall of Incidental text information from Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

(3) Students' free recall of Evoked idea units from

Familiar Metaphoric text and their recall from Unfamiliar Metaphoric text are not significantly different.

The ANOVA of the three Oral Free Recall variables revealed a significant interaction between Version and Topic, F (1,44) = 6.44, $p < .05$. Interpretation of this significant two-way interaction was complicated by a significant three-way interaction amongst Version, Topic and the dependent variables, F (2,88) = 8.67, $p < .05$. These results are presented in Table III in Appendix I. The MANOVA corroborated these findings and implicated Target recall as the main interaction variable (see Table VII in Appendix I).

The MANOVA showed that there was a significant two-way interaction between Version and Topic on Target recall, $T = -3.17930$, $p < .05$. Students who read the Metaphoric versions scored higher on Target recall on the Unfamiliar text (mean in radians = 1.134) than on the Familiar text (mean in radians = 0.860), whereas students who read the Literal versions scored lower on the Unfamiliar text (mean in radians = 0.923) than on the Familiar text (mean in radians = 1.214). The interaction between Version and Topic on Target recall is illustrated in Figure 1 below. The significance of the difference between the two means, Familiar Metaphoric and Unfamiliar Metaphoric, was calculated using the difference method for correlated samples (Ferguson, 1981). The means were significantly different at the .05 level (critical value of t (22, .05) = 2.074; calculated value of t = 8.199) and Hypothesis 1 was not accepted.

For Evoked recall and Incidental recall there were no significant differences between the Familiar and the Unfamiliar Metaphoric texts , and Hypotheses 2 and 3 were accepted. These results are presented in Tables VI and VII in Appendix I.

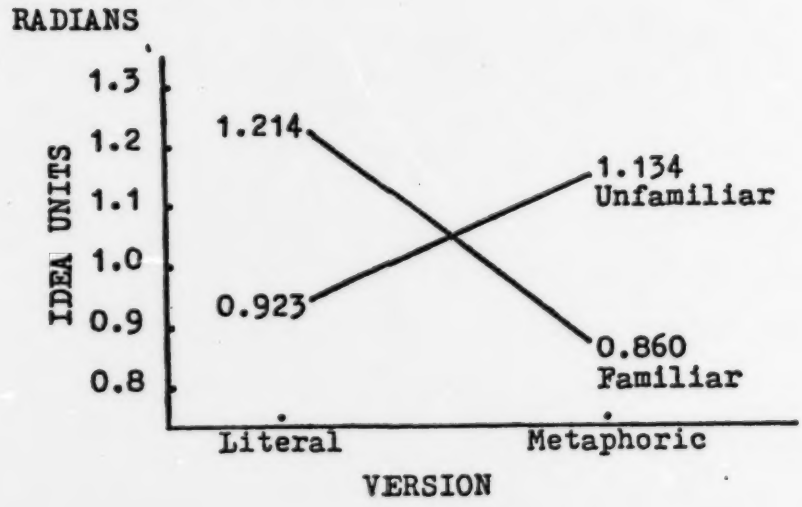

Figure 1

Significant Interaction Between Version and Topic on Target Oral Free Recall

Three specific hypotheses relating to Probed Recall were also formulated. They are as follows:

(4) Students' probed recall of Factual target text information from the Familiar Metaphoric text and their recall from the Unfamiliar Metaphoric text are not significantly different.

(5) Students' probed recall of Incidental Factual text information from the Familiar Metaphoric text and their recall from the Unfamiliar Metaphoric text are not significantly different.

(6) The number of Inferences from targets in the Familiar Metaphoric texts and the number from targets in the Unfamiliar Metaphoric texts are not significantly different.

It is to be noted that, although Topic was not a variable of interest in this study, a main effect for Topic on the Probed Recall measures was revealed by the ANOVA, F (1,44) = 10.19, $p < .05$. Results of the ANOVA are presented in Table IV in Appendix I. Students scored higher on the Familiar topic than on the Unfamiliar topic for both the Metaphoric and the Literal versions, there being no interaction between Topic and Version. The sum of the means in radians for Probed Recall in Version by Topic cells were as follows: Familiar Metaphoric = 6.537, Unfamiliar Metaphoric = 5.26; Familiar Literal = 6.40, Unfamiliar Literal = 6.04.

The ANOVA also revealed a significant two-way interaction between Topic and the dependent variables, F (2,88) = 5.04, $p < .05$. This finding was corroborated and clarified by the

MANOVA which implicated Incidental Factual and Inferential Probed Recall as the measures responsible for the Topic effect. These results are presented in Tables VIII, IX and X in Appendix I.

The results of the MANOVA revealed that for Incidental Factual Probed Recall, there was a significant two-way interaction between Topic and Version, $T = 2.13237$, $p < .05$, in addition to a main effect for Topic, $T = 2.04847$, $p < .05$. Students who read the Metaphoric versions scored significantly lower on the Unfamiliar text (mean in radians = 1.833) than on the Familiar text (mean in radians = 2.290), thus Hypothesis 5 was not accepted. Cell means and the interaction between Version and Topic are illustrated in Figure 2 below.

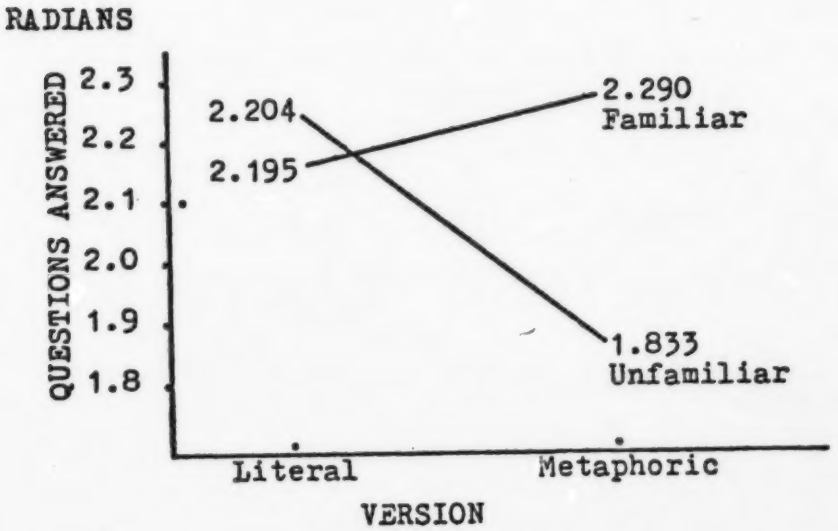

Figure 2

Significant Interaction Between Version and Topic on Incidental Fact Probe Recall

The results of the MANOVA revealed that there was no significant interaction between Topic and Version for either Factual Probed Recall or for Inferential Probed Recall. For Inferential Probed Recall, however, means for both the Metaphoric and the Literal versions were significantly higher for the Familiar text than for the Unfamiliar text, due to the main effect for Topic on this measure, $T = 3.15664$, $p < .05$. On the basis of these findings, Hypothesis 4 was accepted while Hypothesis 6 was not accepted. Cell means for the Probed Recall measures are presented in Table II below.

Table II

Topic Means for Metaphoric Texts on Probed Recall Measures

Measure	Topic		T-Value	Sig. of T
	Familiar	Unfamiliar		
Fact	1.723	1.770	.17117	.864
Incidental Fact	2.290	1.833	2.04847	.044*
Inferential	2.524	1.657	3.15664	.002*

* $p < .05$

One hypothesis relating to the multiple-choice Metaphor Probe was also formulated. It is as follows:

(7) Students' recognition of the correct interpretations of Metaphor Targets from the Familiar Metaphoric text and their recognition of those from the Unfamiliar Metaphoric text are not significantly different.

Data from the Metaphor Probe were not included in the ANOVA or the MANOVA. Students' responses to the Familiar and the Unfamiliar multiple-choice questions, however, were compared using the procedure for calculating the significance of the difference between two means for correlated samples (Ferguson, 1981). The means (Familiar = 6.39, Unfamiliar = 6.65) were significantly different at the .05 level (critical value of t (22, .05) = 2.074; calculated value of t = 5.23). Hypothesis 7 was rejected.

3. SUMMARY OF FINDINGS

3.1 Finding Regarding The Effect Of Metaphor

(1) There were no significant differences between students' comprehension of the Metaphoric and the Literal texts on any of the three Oral Free Recall measures or on any of the Probed Recall measures.

3.2 Findings Regarding The Effect Of Topic On Metaphoric Texts

(1) Students' Oral Free Recall of Target idea units was significantly greater for the Unfamiliar Metaphoric text than for the Familiar Metaphoric text.

(2) Students' recognition of the correct interpretations of Metaphor Targets was significantly greater for the Unfamiliar

Metaphoric text than for the Familiar Metaphoric text.

(3) Students' Probed Recall of Incidental Factual information was significantly greater for the Familiar Metaphoric text than for the Unfamiliar Metaphoric text.

(4) There were no significant differences between the Familiar and the Unfamiliar Metaphoric texts on: students' Oral Free Recall of Incidental idea units, students' Oral Free Recall of Evoked idea units and their Probed Recall of Factual target idea units.

V. DISCUSSION AND CONCLUSIONS

In this chapter the findings reported in Chapter 4 are discussed and evaluated and possible implications for educational practice are presented. Conclusions drawn from the study are reported and implications for further research are proposed.

The present study was designed to answer two questions about the effects of metaphor on children's comprehension of expository text, namely:

(1) Is there a difference between children's comprehension of texts containing metaphors and their comprehension of texts containing the literal equivalents of the metaphors?

(2) Is there a difference between children's comprehension of metaphoric texts on a familiar topic and their comprehension of metaphoric texts on an unfamiliar topic?

1. THE EFFECT OF METAPHOR ON COMPREHENSION

With regard to the first question, no difference was found between students' comprehension of texts containing metaphors and their comprehension of texts containing the literal equivalents of the metaphors. This was true for the three measures of oral free recall and for the three measures of probed recall. All six null hypotheses concerning the effects of metaphor on children's comprehension of text were thus accepted.

The findings of the present study support the findings of previous research (Arter, 1976; and Pearson *et al.*, 1979). Arter found no significant difference between her sixth-grade

students' comprehension of a metaphoric text and their comprehension of an equivalent literal text except for her low-ability students who performed better on multiple-choice probed recall questions about incidental material in the metaphoric text than on the same kind of questions for the literal text. (Arter suggested that this finding was probably due to the fact that low verbal ability students tend to have less effective study strategies than middle and high verbal ability students and that the metaphors likely encouraged further processing of the material thus helping their comprehension.) Pearson, Raphael, TePaske and Hyser (1979), using subjects of high and low ability at the third and sixth-grade levels, found no difference in comprehension of texts containing metaphors and comprehension of texts containing the equivalent literal phrases.

The finding that metaphor did not affect students' recall of expository text may be interpreted as indicating that the metaphoric versions were at least as comprehensible and as memorable as the literal versions. This finding is contrary to the claims by Cunningham (1976) and Winkeljohann (1979) that metaphoric language makes for difficulty in reading comprehension. The finding is consistent with the claims of Ortony et al. (1978) and Baldwin et al. (1982) that the difficulty of processing metaphoric language is not a function of non-literalness but depends upon the subjects' knowledge of the vehicle of the metaphor and upon the relatedness of the context surrounding the metaphor.

These claims carry pedagogical implications which have already been addressed in part by Baldwin et al. (1982). They suggest that instructional effectiveness in helping children comprehend metaphor in text may lie in increasing students' knowledge, rather than in increasing their abilities to analyze and interpret language forms. Thus is would appear that educators may best be concerned with designing curriculum experiences to develop students' vocabulary, to develop their knowledge of the world and cultural conventions, and to increase their experiences with language and literature, rather than with designing direct metaphor comprehension training activities.

2. THE EFFECT OF TOPIC ON COMPREHENSION OF METAPHORIC TEXTS

The second question examined in the present study was: Is there a difference between children's comprehension of metaphoric texts on a familiar topic and their comprehension of metaphoric texts on an unfamiliar topic? On the oral free recall measures, students' recall of the target metaphors was significantly better for the text on the unfamiliar topic than it was for the text on the familiar topic. Material other than the target metaphors, however, was not recalled better for the unfamiliar text than for the familiar text.

There was a similar result in favour of the unfamiliar metaphoric text on the multiple-choice metaphor probe. In this multiple-choice written test of students' ability to recognize the correct interpretations of the metaphors, students performed significantly better on the unfamiliar topic than on the familiar topic.

On the probed recall measures, there was a significant main effect for topic with a higher overall score for the familiar text than for the unfamiliar. A topic effect in favour of the familiar topic might have been expected. One influential theory of reading comprehension (e.g., Anderson, 1977; and Rumelhart, 1980) suggests that readers construct meanings based partly on the text and partly on their prior knowledge. Comprehension may be expected to be better on a topic on which a reader knows much than on a topic on which a reader knows little. Furthermore, in tests of recall of a text just read, results inevitably reflect not only what subjects have learned from the text, but pre-existing knowledge as well.

For the metaphoric texts in the present study, scores for both the inferential and the incidental questions on the probed recall test were higher for the text on the familiar topic than they were for the text on the unfamiliar topic, thus reflecting the overall topic effect. In contrast, scores for the factual questions were no different for the familiar and the unfamiliar texts. These results are presented in Table II on page 83.

In summary, then, scores were higher for the unfamiliar metaphoric text than for the familiar text on two measures: the oral free recall of the target metaphors, and the multiple-choice metaphor probe (a recognition-of-meaning test). Both these measures, it will be noted, involved the target metaphors. For a third measure involving the target metaphors, namely the factual questions on the probed recall test, there was no difference between students' comprehension of the familiar

metaphoric text and their comprehension of the unfamiliar metaphoric text.

Some discussion seems warranted about the difference between oral free recall and the recognition-of-meaning test, on the one hand, and probed recall, on the other, as measures of comprehension. As already noted, for the two former tests of comprehension, there was a significant difference in favour of the unfamiliar text (that is, for questions dealing specifically with the target metaphors). In probed recall, there were two sets of questions dealing with target metaphors: factual dealt with students' ability to remember the facts explicitly conveyed by the metaphors while inferential dealt with students' ability to draw inferences from the content of the metaphors. As noted above, there was a trend in the direction of support for factual questions in that scores for the unfamiliar and familiar texts were the same, that is, the main effect for topic was not manifest. For inferential probe recall, however, the overall topic effect in favour of the familiar topic was evident. These findings are interpreted as indicating that there may be a qualitative difference between the comprehension elicited by probe recall measures, and the comprehension elcited by free recall and recognition-of-meaning measures. This interpretation is supported by previous research.

In their study of children's recall of familiar and unfamiliar text, Marr and Gormley (1982) found that prior knowledge and comprehension ability were the strongest predictors of comprehension performance. They also noted that

oral free recall measures elicited text-based responses and that probe recall questions encouraged more responses based on prior knowledge. They postulated that the students provided most of the comprehended information in their oral free recalls, and that, when questioned further (probed), they provided whatever seemed relevant from their prior knowledge, that is, their familiarity with the topic. Furthermore, they noted that general prior knowledge of the topics was the strongest predictor of the students' ability to draw inferences and elaborate. This notion receives support from the work of Johnson (1983) and Tierney, Bridge and Cera (1978) which suggests that probed recall measures may induce additional processing of text information and thus a greater use of prior knowledge, whereas in oral free recall a greater reliance on text-learned information is evident.

The results discussed above indicate that the information conveyed by the metaphors was better remembered in unfamiliar text than in familiar text. These results are interpreted as indicating that metaphor had a facilitative effect when the topic of the text was unfamiliar but not when the topic was familiar. The metaphors, however, did not affect memory for the surrounding incidental material. Pearson, Raphael, TePaske & Hyser (1979) likewise found no significant effect for comprehension of surrounding incidental material, and they contend that whatever metaphor effects exist appear to be limited to the surface structure boundaries of the metaphors.

The finding that metaphor had a facilitative effect when

the topic of the text was unfamiliar but not when the topic was familiar may be attributable to the bridging function of metaphor espoused by Ortony (1975) and Petrie (1979): that is, a metaphor allows a reader to transfer knowledge from the known (the vehicle) to the unknown (the topic). In situations where the topic of the text is unfamiliar, one might expect the metaphor to be more vivid and thus more memorable than it would be if the topic was more familiar. An analogous situation is observed with illustrations in text. Illustrations are more useful--and more necessary--when explaining new concepts. Metaphors are a kind of illustration, a compact and vivid image of an idea, concept or experience which is expressed in a novel way. In the same way that illustrations are not as useful or as memorable when they portray that which is already known, neither are metaphors.

The finding of the present study regarding the facilitative effect of metaphor in unfamiliar text on the free recall of target metaphors is interesting in that it is a result that both Arter (1976) and Pearson et al. (1979) predicted but did not achieve. As shown in Figure 1 (on page 80), students who read the literal versions of the texts recalled more target information from the familiar text than from the unfamiliar text as might have been expected. In contrast, students who read the metaphoric versions recalled more target information from the unfamiliar text. Arter (1976) did not achieve the predicted result due to methodological difficulties. Pearson et al. (1979) produced this result only in the first of their three

experiments. They were unable to analyze, in a meaningful way, the results of target free recall in their final experiment due to a "floor effect" resulting from poor student recall. Pearson et al. stated that on the average, students recalled only 1.0 out of 10 possible target idea units; that is, ten percent recall. In the present study, students recalled on the average 2.16 out of 8 possible target idea units; that is, 27 percent recall. The greater rate of recall in the present study may have been a function of the age and number of subjects. Pearson et al. used 23 third-grade and 26 sixth-grade students while the present study employed 46 seventh-grade students.

With regard to the present study, it is suggested that the facilitative effects of metaphor in unfamiliar text were evident in the free recall and the recognition-of-meaning measures of target information because students were relying primarily on text-learned information to respond. In these tasks, the bridging function of metaphor hypothesized by Ortony (1975) and Petrie (1979) was able to operate. For students' responses to the probed recall questions, however, no difference in favour of the unfamiliar scores was produced, although there was an effect of a kind for factual questions. On this measure there was no difference in students' ability to answer questions from the familiar and from the unfamiliar texts. In contrast, there was a topic effect in favour of the familiar text on the other probed recall measures. It is suggested that in responding to the probed recall questions, students relied more heavily on their prior knowledge of topics than on text information,

including the metaphors. This possibility suggests the need for further research on the nature and relationship of the various measures widely used in comprehension research.

The finding of the present study in regard to factual probe recall is consonant with the finding of Pearson et al. (1979), despite a difference. While Pearson et al. found a significant interaction effect on factual probe recall indicating a facilitative effect for metaphor when the topic of the text was unfamiliar but not when the topic was familiar, the present study found only an effect of a kind in that there was no difference in students' answers for these questions. This finding contrasted with the overall topic effect in favour of the familiar which was evident for the other two measures of probed recall (inferential and incidental factual). It is suggested that the difference in findings between the two studies may be attributable to the fact that Pearson et al. asked factual questions concerning the metaphors only when the target had not been voluntarily recalled in the preceding oral free recall task. In the present study all students were asked the entire battery of probe recall questions following the oral free recall task; thus a greater degree of extra processing of information and a greater stimulation of prior-knowledge may have been induced in the present study. Pearson et al. did not investigate the ability of their students to answer inferential questions concerning the metaphors, so a comparison with these findings was not possible.

To sum up, then, the findings in regard to the second

question show that there were indeed differences between students' comprehension of metaphoric texts on an unfamiliar topic and their comprehension of metaphoric texts on a familiar topic. These differences, however, were confined to comprehension of the information conveyed by the target metaphors, and were not extended to students' comprehension of surrounding incidental material.

It appears that students are able to remember the information conveyed by metaphors and to recognize the correct interpretations of the metaphors better when the topic of a metaphoric text is unfamiliar than when it is familiar, possibly due to the stimulation of vivid imagery and the hypothesized "bridging" function of metaphor hypothesized by Ortony (1975) and Petrie (1979). This suggests that metaphors act as illustrative material which may well be used by writers of expository text to clarify and to increase memory for unfamiliar concepts.

The results of the present study, however, do not lend support to the idea that the facilitative effects of metaphor extend to text as a whole, that is, to the surrounding material. Nonetheless, it is possible that this effect would occur if the metaphors were positioned in idea units of high structural importance. This possibility is augured by the findings of the study by Reynolds and Scwartz (1979), in which a comparison was made of students' comprehension of passages with either literal or metaphoric summarizing statements, that is, units high in the structural hierarchy of the texts. These researchers found that

the metaphoric conclusions increased memory for passage information as a whole. It should be noted, however, that several texts on unfamiliar topics, and several texts on familiar topics would be required in order to test the effects of metaphors in positions of high structural importance upon overall text comprehension, for short texts contain few high level idea units. Furthermore, texts densely embedded with metaphors appear unnatural; for example, the metaphoric texts employed in the study by Cunningham (1976). The construction of texts on familiar and unfamiliar topics which are similar in discourse structure, and which contain approximately the same number of idea units as well as equivalent literal and metaphoric targets is not a easy task. The difficult nature of this task became evident in the early stages of the present study.

3. SUMMARY AND IMPLICATIONS FOR CLASSROOM PRACTICE

Metaphor does not appear to pose a problem to students' comprehension of expository text, and in some situations (that is, when the topic of the text is unfamiliar and the vehicles of the metaphors are known) metaphor may even facilitate students recall of information. As discussed in the preceding section on the effect of metaphor, educators may best be concerned with designing curriculum experiences to develop students' vocabulary, knowledge and experience with language rather than with direct metaphor training exercises. Furthermore, publishers of children's texts may wish to incorporate this natural language form in texts to illustrate possibly unfamiliar

concepts or to enhance the memorability of specific ideas, rather than avoiding using metaphor due to its hitherto supposed troublesome nature.

4. CONCLUSIONS

On the basis of the results presented in Chapter 4 and the discussion of the results presented in the present chapter, several conclusions are offered. They are as follows:

(1) There are no differences between students' comprehension of texts containing metaphors and their comprehension of texts containing equivalent literal phrases.

(2) Under certain conditions, students' ability to remember and to comprehend information is facilitated by metaphors; namely, when the vehicles of the text are known and when the topic of the text is unfamiliar.

(3) Under these same conditions, students' ability to answer factual questions based on the metaphors is no different from their ability to answer factual questions from the familiar text. This finding demonstrates an effect of a kind, however, for topic significantly affected the other measures of probed recall in favour of the familiar text.

(4) The different findings from the free recall and recognition-of-meaning measures, on the one hand, and the probed recall measures, on the other, were interpreted as indicating that there are qualitative differences in the comprehension evidenced by these two sets of measures.

(5) Metaphor effects appear to be limited to the surface structure boundaries of the metaphors. Metaphors do not appear

to facilitate the comprehension of the incidental textual information in which they are embedded.

(6) Although metaphors appear with some frequency in basal readers, metaphor is not a language form which children need to be taught to analyze and interpret. If children are experiencing difficulties comprehending texts containing metaphors, they likely will benefit from curriculum activities designed to build their vocabularies, to help them use contextual cues as an aid to comprehension, to expand their experiences with language and literature and to develop their general knowledge.

(7) Writers and publishers of children's texts should be aware that metaphor is not a troublesome aspect of language with which children need help. Rather, it is a natural language form which may be used to enhance children's memory and comprehension of specific ideas from a text concerning a topic with which they are unfamiliar.

5. IMPLICATIONS FOR FURTHER RESEARCH

It is apparent that students' comprehension of texts containing metaphors is as good as their comprehension of texts containing the literal equivalents of the metaphors, and that under certain conditions--when the topic of the text is unfamiliar and when the vehicles of the metaphors are known--students' ability to remember and to comprehend information conveyed by the metaphors is better from a text with an unfamiliar topic than it is from a text with a familiar topic. There are, however, many more questions to study in this still

largely unexplored area concerning the effects of a specific discourse feature (metaphor) on text comprehension and learning.

In regard to the nature of the experimental texts, it would be valuable to investigate the effects of metaphor on comprehension with other types of discourse; for example, narrative and argument. It would also be valuable to investigate the effects on comprehension of metaphors in specific positions within the structural hierarchy of texts, and particularly, in higher level positions in the structure. The study by Reynolds and Schwartz (1979) examining the effects of metaphoric conclusions on adults' comprehension of text foreshadows this area of investigation. The failure to find metaphor effects beyond the boundaries of the metaphor targets in studies of children's comprehension of texts containing metaphor (Arter, 1976; Cunningham, 1976; Pearson et al., 1979; Winkeljohann, 1979; and the present study) may be related to the fact that the studies have not controlled for the position of the metaphors in the discourse structure of the experimental texts. Rather, the texts employed have contained many metaphors in random positions.

With regard to the characteristics of the subjects, the informal debriefing interview revealed that while some subjects enjoyed reading about an unknown topic (Wombats) and meeting unusual uses of language (metaphors), many did not. It would be valuable to consider specific aspects of the affective domain--attitude towards reading, learning style, interest in the unknown--when designing further research on the effects of

metaphor on text comprehension and learning.

In regard to the reading strategies employed by the subjects, an oral rather than a silent reading of the experimental texts would likely provide additional complementary information to assist an investigation of the effects of metaphor on students' comprehension of text.

Finally, with regard to the criterial tasks, the different findings of the oral free recall and recognition-of-meaning measures, and the probed recall measures bear further investigation both in terms of metaphor effects and measurement of text comprehension. Are the different findings a result of the different integration, retrieval and/or production demands of the tasks? What is the qualitative difference in comprehension evidenced by free recall, probed recall and recognition measures? Would these differences be altered if delayed as well as immediate comprehension measures were employed? Furthermore, is there a contributing effect of the "inexpressibility" thesis of metaphor proposed by Ortony (1975)? Perhaps students are better able to recall and to recognize the meanings of metaphors about unfamiliar topics than those about familiar topics due to their "vividness", but when students are probed for information, they find it as difficult or more difficult to integrate the new information, to draw inferences, and to express themselves in an appropriate oral answer due to the greater "compactness" and "inexpressibility" of a metaphor on an unfamiliar topic. Further research on the effects of topic on the comprehension of expository texts containing

metaphors as well as on the relationship and nature of various measures of comprehension is warranted.

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APPENDIX A - FAMILIAR TEXT

Among the snow covered islands and icy waters of the Arctic coast lives the second largest bear in the world - the polar bear. When fully grown, this large white-furred animal (marshmallow giant) stands one to one and a half meters high at the shoulders, and is about two and a half meters long from nose to tail.

Polar bears are well adapted to their arctic home. Their white fur coats (shag rugs) make them difficult to see against the ice and snow, and keep them warm in the sub-zero temperatures. An extra membrane (Built-in sunglasses) over their small black eyes protects them from the glare of the ice and snow. Large paws with fur between the pads give them a non-slip grip (a grip like studded snow tires) as they move across the ice. Their strong legs can spread wide apart when they walk so that although they may weigh as much as four hundred kilograms (a large refrigerator), they can travel across ice too thin to hold up a man.

Like most bears, the polar bear lives alone. Polar bears only come together for a few days in the spring to mate. The pregnant female then has all summer to gain weight and store up a thick layer of fat for the coming winter. In the fall, the female digs a den (a cozy animal igloo) for herself in a snowy slope. She then takes her winter sleep, and in December or January, gives birth to two cubs. By late March, the cubs are all furred out, and weigh about six kilograms each. They are then ready to go outside (to leave their sheltered cocoon). The cubs stay with their mother while she hunts, and soon they learn to hunt and swim. After two years they leave their mother and live alone too.

For most of the year the polar bear dines on seals. Keen eyesight and smell help the bear in its hunt. The bear is very good at sniffing out (This northern Sherlock Holmes can detect) a snow cave that is protecting baby seals. When seals are not available, the bear will eat anything it can find such as birds, berries, grasses, eggs or even a stranded whale.

Polar bears usually live to be fifteen or twenty years old, and in zoos have even lived to be thirty years old. The lives of polar bears, however, have been endangered more and more during recent years by big hunting operations and oil spills. Polar bears must be protected by humans if they are to survive.

Literal Equivalent Targets - underlined

Metaphor Targets - underlined in parentheses

APPENDIX B - UNFAMILIAR TEXT

There are two kinds of wombat; the common wombat and the hairy-nosed wombat. These wombats are slightly different in appearance, and live in very different habitats.

The common wombat lives alone in (is the Lone Ranger of) the forests of Eastern Australia. It has a dark brown coat which is thick and coarse, and a bare black muzzle (muzzle like a dog's).

In contrast, the hairy-nosed wombat has, as its name shows, a muzzle covered by the short fur of the face. It also has a fine silky coat which varies in color from grey-black to yellow. This wombat lives in large groups (wombat villages) in the almost treeless "outback" of South Australia. Both kinds of wombat are burrowers. They are strongly built (built like weight-lifters) with thick set bodies, short front legs and powerful shoulders. Their front paws have strong curved nails (nails like small shovels), while their back paws have soft pads. To dig a burrow, the wombat sits on its rear end and hacks out the earth with its forepaws, pushing it to one side. Then the animal backs out of the tunnel kicking dirt as it goes. A wombats burrow is deep, and in some cases, large enough for a man to crawl into.

Wombats come out of their burrows at night. They feed on grasses. (The wombats' dinner table is a field of grass). Farmers have no use for the animals because they sometimes tear large holes in fences and eat the crops. Wombats can occasionally be seen by day as well. On warm winter days, wombats often lie (sunbathe) near the openings to their burrows. At these times they are easily caught.

In the middle of winter, a female wombat gives birth to one baby wombat or joey, which it carries in its pouch until it is large enough to feed on grass. A wombat's pouch has two nipples, but only one baby can live even when two are born. There simply isn't enough room for two, and even with one joey, the pouch scrapes on the ground at times.

The largest wombat grows to be more than one meter long, and may weigh as much as thirty-two kilograms (a ten year old child) when it is fully grown. A wombat also has a large head, round ears and small eyes. It looks stupid and grumpy, but it is not. A wombat is easily tamed, and being a long lived animal, makes a good pet.

Literal Equivalent Targets - underlined

Metaphor Targets - underlined in parentheses

APPENDIX C - PRIOR KNOWLEDGE PRETEST

1. PART A

Instructions: Write down all you know about Polar Bears in the space provided below. Write words or phrases rather than complete sentences. The ten items in the column on the left will help you think of things you know about the animal.

Example: Here is an example of what you are required to do.

Donkeys

1. Color; grey
2. Size: small horse, one and an half meters long
3. Weight: don't now
4. Appearance: pointed furry ears, hoofs like a horse
5. (etc.)

POLAR BEARS

1. Color:

2. Size:

3. Weight:

4. Appearance:

5. Favorite Foods:

6. Habitat (place where it lives):

7. Habits (when it sleeps, eats, has babies etc.):

8. Length of Life:

9. Things which might endanger a polar bear's life:

10. Any other facts that you know about polar bears:

2. PART B

Instructions: Write down all you know about Wombats in the space provided below. Write words or phrases rather than complete sentences. The ten items in the column on the left will help you think of things you know about the animal.

Example: Here is an example of what you are required to do.

Donkeys

1. Color; grey
2. Size: small horse, one and an half meters long
3. Weight: don't now
4. Appearance: pointed furry ears, hoofs like a horse
5. (etc.)

WOMBATS

1. Color:

2. Size:

3. Weight:

4. Appearance:

5. Favorite Foods:

6. Habitat (place where it lives):

7. Habits (when it sleeps, eats, has babies etc.):

8. Length of Life:

9. Things which might endanger a wombat's life:

10. Any other facts that you know about wombats:

3. PART C

Instructions: Please read the following definitions carefully, and choose the phrase which best gives the meaning of the underlined word or words. Circle the number of the answer which you choose.

Example: Here is an example of what you are required to do.

(1) A school is:
1. a place where people play hockey
2. a place where people learn
3. a place where people worship
4. a place where people eat

(a) The Lone Ranger is:
1. a person who is lonely
* 2. a person who lives and travels across the countryside alone
3. a Ranger who is lonely
4. a person who is all alone

(b) A dog is:
* 1. a kind of animal
2. a kind of mineral
3. a kind of vegetable
4. a kind of person

(c) A village is:
1. a country house
2. a house in the suburbs
* 3. a group of houses
4. a wicked person

(d) A weight-lifter is:
1. a weighing machine
2. a person who watches their weight
* 3. a person who lifts weights
4. a lifting machine

(e) A shovel is:
1. a sliding movement
2. a hinged wooden panel
3. a tool for weaving cloth
* 4. a tool for digging and moving earth

(f) A dinner table is:
1. the furniture on which the earliest meal of the day is eaten
* 2. the furniture on which the main meal of the day is eaten
3. the furniture on which people sit
4. the furniture on which people play

(g) To sunbathe is:
1. to wash in the sun
* 2. to lie outstretched in the sun
3. to play in the sun
4. to take a bath in the sun

(h) The weight of a ten-year old child is:
1. 3 kilograms
* 2. 30 kilograms
3. 300 kilograms
4. 3,000 kilograms

(i) A marshmallow giant could be:
1. a plain white woven cloth
2. a white spicy root
3. a person dressed in white who wanders across the earth
* 4. a huge fairytale creature who is dressed in white

(j) A shag rug is:
1. a kind of untanned leather
2. a cormorant bird
* 3. a coarse carpet with a long cut pile
4. a smooth plush carpet

(k) Built-in sunglasses are most likely:
* 1. glasses that protect the eyes which are "built-in" to something
2. glasses tinted to protect the eyes
3. glasses with a "built-in" sun
4. glasses for wearing in the sun

(l) Studded snow tires are:
1. tires scattered over the snow
2. tires which need studs for the snow
3. tires studded with snow
* 4. tires with studs to provide a grip on the snow

(m) A large refrigerator weighs:
1. 4 kilograms
2. 14 kilograms
* 3. 400 kilograms
4. 4,000 kilograms

(n) A cozy animal igloo is probably:
1. an igloo for cozy animals
* 2. a cozy animal home made of ice and snow
3. a cozy animal home
4. a cozy igloo for animals

(o) A cocoon is:
* 1. a protective covering made by insect larvae
2. a powder made from crushed seeds and roots
3. a tropical palm tree
4. a furry animal

(p) Sherlock Holmes is:
1. a person who is very good at determining laws
* 2. a person who is very skilled at detecting evidence
3. a person who is good at making decisions
4. a person who is excellent at describing

* indicates the correct answer

APPENDIX D - TEXT BASE TEMPLATE - UNFAMILIAR METAPHORIC

01. there are two kinds of wombat
02. the common wombat
03. and the hairy-nosed wombat
04. these wombats are slightly different in appearance
05. and live in very different habitats
06. the common wombat is the Lone Ranger
07. of the forests
08. of Eastern Australia
09. it has a dark brown coat
10. which is thick
11. and coarse
12. and a muzzle
13. like a dog's
14. in contrast
15. the hairy-nosed wombat has, a muzzle
16. as its name shows
17. covered by the short fur of the face
18. it also has a fine silky coat
19. which varies in color from grey-black to yellow
20. this wombat lives in wombat villages
21. in the "outback"
22. almost treeless
23. of South Australia
24. both kinds of wombat are burrowers
25. they are built like weight-lifters
26. with thick set bodies
27. short front legs
28. and powerful shoulders
29. their front paws have nails
30. like small shovels
31. while their back paws have soft pads
32. to dig a burrow
33. the wombat sits on its rear end
34. and hacks out the earth with its forepaws
35. pushing it to one side
36. then the animal backs out of the tunnel
37. kicking dirt as it goes
38. A wombats burrow is deep
39. and in some cases
40. large enough for a man to crawl into
41. wombats come out of their burrows at night
42. the wombats' dinner table is a field of grass
43. farmers have no use for the animals
44. because they sometimes tear large holes in fences
45. and eat the crops
46. Wombats can occasionally be seen by day as well
47. on warm winter days,
48. wombats often sunbathe near the openings to their burrows
49. at these times they are easily caught
50. in the middle of winter
51. a female wombat gives birth to one baby wombat

52. or joey
53. which it carries in its pouch
54. until it is large enough to feed on grass
55. a wombat's pouch has two nipples
56. only one baby can live
57. even when two are born
58. there simply isn't enough room for two
59. and even with one joey
60. the pouch scrapes on the ground at times
61. the largest wombat grows to be more than one meter long
62. and may weigh as much as a ten-year old child
63. when it is fully grown
64. A wombat also has a large head
65. round ears
66. and small eyes
67. it looks stupid
68. and grumpy
69. but it is not
70. a wombat is easily tamed
71. and being a long lived animal
72. makes a good pet

APPENDIX E - ORAL FREE RECALL PROTOCOL - UNFAMILIAR METAPHORIC

01. (I) there's two main kinds of wombat
02. (I) the commom wombat
03. (I) and the hairy-nosed wombat
06. (E) the hairy-nosed wombat is the Lone Ranger
08. (I) of Eastern Australia
10. (I) and has a thick brown
11. (I) coarse
10. (I) coat
12. (I) and a muzzle
13. (T) like a dog's
19. (I) the hairy nosed wombat has a grey blackish to yellow fur
23. (I) and it lives in South Australia
24. (I) and both wombats are burrowers
25. (T) and are built for burrowing
29. (E) with nail
30. (E) like paws
27. (E) and short arms
33. (I) they sit on their rear ends
34. (I) and hackk away at the dirt
32. (I) to burrow in
41. (I) and they come out at night
00. (E) usually
42. (T) and they feed on grass
43. (I) farmers have no use for them
45. (I) because they eat crops
44. (I) and they tear away fences
50. (I) in the winter
51. (I) the female wombat gives birth to one or two
57. (I) but if there's two
56. (I) only one can live
58. (I) because the pouch is only built for one
58. (E) or can only fit one wombat
00. (E) so the other dies
53. (I) the wombat lives in the pouch
54. (I) until its big enough to feed on grass

NUMBER OF IDEA UNITS RECALLED

(I) = Incidental - 24

(E) = Evoked - 7

(T) = Target - 3

APPENDIX F - PROBED RECALL QUESTIONS

Familiar Metaphoric Text

(IF) 1. Where do polar bears live?

(F) 2. What do polar bears look like?

(F) 3. What protects polar bears' eyes from the glare of the ice and snow?

(IF) 4. How do polar bears travel across thin ice?

(F) 5. What stops a polar bear from slipping as it moves across the ice?

(F) 6. How much can a polar bear weigh?

(IF) 7. What does a female polar bear do during the summer?

(I) 8. Why does the female polar bear need a cozy animal igloo?

(F) 9. What do the cubs do when they're all furred out?

(I) 10. Why do you think that the cubs do not leave their cocoon until they're all furred out and weigh about six kilograms?

(IF) 11. What does a mother polar bear teach her cubs?

(F) 12. How does the polar bear find baby seals?

(I) 13. Why does the polar bear need to be a northern Sherlock Holmes?

(IF) 14. What will a polar bear eat when seals are not available?

(IF) 15. How long can a polar bear live?

(F) = Factual Question

(IF) = Incidental Factual Question

(I) = Inferential Question

Unfamiliar Metaphoric Text

(IF) 1. What kind of coat does the common wombat have?

(F) 2. What kind of muzzle does the common wombat have?

(IF) 3. What kind of coat does the hairy-nosed wombat have?

(F) 4. What does it say in the passage about a wombat's build?

(I) 5. Why do you think wombats are built like weight lifters?

(F) 6. Describe a wombat's front paws.

(I) 7. Why do wombats need to have nails like small shovels on their front paws?

(IF) 8. What is a wombat's burrow like?

(F) 9. What do wombats eat?

(IF) 10. Why do farmers dislike wombats?

(F) 11. What do wombats often do on warm winter days?

(IF) 12. Where does a wombat baby or joey live until it is old enough to eat grass?

(F) 13. How much does a fully grown wombat weigh?

(IF) 14. Why does a wombat make a good pet?

(I) 15. Why do wombats often sunbathe near the openings to their burrows?

(F) = Factual Question

(IF) = Incidental Factual Question

(I) = Inferential Question

APPENDIX G - MULTIPLE-CHOICE METAPHOR PROBE

Familiar Text

Instructions: Please read each sentence carefully, and think about the meaning of the underlined words. You are to choose from the phrases given below, the one which you think best gives the meaning of the underlined words.

Example: Here is an example of what you are required to do.
(a) The new boy in our class is built like a tank.

1. short and brave
* 2. short and very strong
3. tall and brave
4. tall and full of courage

(a) When fully grown, this marshmallow giant stands one to one and a half meters high at the shoulders, and is about two and a half meters long from nose to tail.

1. powerful marshmallow animal
2. legendary white animal
* 3. large white-furred animal
4. large marshmallow animal

(b) Polar bears' white shag rugs make them difficult to see against the ice and snow, and keep them warm in the sub-zero temperatures.

* 1. fur coats
2. coarse mats
3. plush rugs
4. smooth coats

(c) Built-in sunglasses over their small black eyes protects them from the glare of the ice and snow.

1. tinted glass covers
2. glasses for wearing in the sun
* 3. an extra membrane
4. sunglasses built-in to their skin

(d)Large paws with fur between the pads give polar bears a grip like studded snow tires.

1. rubber grip
2. round studded grip
3. slippery grip
* 4. non-slip grip

(e) Polar bears' legs can spread wide apart when they walk so that although they may weigh as much as a large refrigerator, they can travel across ice too thin to hold up a man.

* 1. 400 kilograms
2. 40 kilograms
3. 14 kilograms
4. 4 kilograms

(f) In the Fall, the female polar bear digs a cozy animal igloo for herself in a snowy slope.

* 1. a den
2. a hole
3. a winter bed
4. an igloo

(g) By late March, the cubs are all furred out, and weigh about six kilograms each. Yhey are then ready to leave their sheltered cocoon.

1. to leave their mother
* 2. to leave their den
3. to leave the other cub
4. to leave their covering

(h) This northern Sherlock Holmes can detect a snow cave that is protecting baby seals.

1. the bear usually sniffs out
2. the bear sometimes sniffs out
* 3. the bear is very good at sniffing out
4. the bear can not sniff out

* indicates the correct answer

Unfamiliar Text

Instructions: Please read each sentence carefully, and think about the meaning of the underlined words. You are to choose from the phrases given below, the one which you think best gives the meaning of the underlined words.

Example: Here is an example of what you are required to do.

(a) The new boy in our class is built like a tank.

1. short and brave
* 2. short and very strong
3. tall and brave
4. tall and full of courage

(a) The common wombat is the Lone Ranger of the forests of Eastern Australia. temperatures.

* 1. lives alone in
2. is lonely in
3. is a lonely Ranger in
4. is a Ranger in

(b) The common wombat has a dark brown coat which is thick and coarse, and a muzzle like a dog's.

1. a furry pink muzzle
2. a furry muzzle
* 3. a bare black muzzle
4. a bare pink muzzle

(c) The hairy-nosed wombat lives in wombat villages in the almost treeless "outback" of South Australia.

1. alone
* 2. in large groups
3. in little houses
4. in big houses

(d) Wombats are built like weight-lifters, with thickset bodies, short front legs and powerful shoulders.

1. thickly built
* 2. strongly built
3. built to lift heavy weights
4. built to lift

(e) Wombats' front paws have nails like small shovels, while their back paws have soft pads.

1. sliding nails
2. small bent nails
3. long nails
* 4. strong curved nails

(f) The wombats' dinner table is a field of grass.

1. wombats eat grass at a table
2. wombats feed on grass at the dinner table
* 3. wombats feed on grasses
4. a wombat's table is made of grass

(g) On warm winter days, wombats often sunbathe near the openings to their burrows.

* 1. often lie outstretched in the sun
2. often wash in the sun
3. often play in the sun
4. often take a bath in the sun

(h) The largest wombat grows to be more than one meter long, and may weigh as much as a ten year old child when it is fully grown.

1. 3 kilograms
* 2. 32 kilograms
3. 302 kilograms
4. 3,002 kilograms

* indicates the correct answer

APPENDIX H - DEBRIEFING INTERVIEW SCHEDULE

(1) Did you find this passage interesting to read? Explain.

(2) Was this passage easy or difficult to read? Can you tell me why? Explain.

(3) Was this passage easy or difficult for you to understand? Explain.

(4) How much do you feel you know about the topic of this passage; that is, before you read the passage and and after you read the passage?

APPENDIX I - TABLES

Table III - ANOVA for Oral Free Recall Measures

Table IV - ANOVA for Probed Recall Measures

Table V - MANOVA for Incidental Oral Free Recall

Table VI - MANOVA for Evoked Oral Free Recall

Table VII - MANOVA for Target Oral Free Recall

Table VIII - MANOVA for Factual Probed Recall

Table IX - MANOVA for Incidental Factual Probed Recall

Table X - MANOVA for Inferential Probed Recall

Table III

ANOVA for Oral Free Recall Measures

Source	df	Mean Square	F	Tail Prob
(A) VERSION	1	0.14737	1.07	0.3072
COVARIATE	1	1.8372	8.58	0.0054*
ERROR	43	0.13799		
(B) TOPIC	1	0.01459	0.18	0.6748
B X A	1	0.52671	6.44	0.0148*
ERROR	44	0.08179		
(C) MEASURES	2	11.66586	137.21	0.0000*
C X A	2	0.01397	0.16	0.8488
ERROR	88	0.08502		
B X C	2	0.01353	0.17	0.8466
B X C X A	2	0.70347	8.67	0.0004*
ERROR	88	0.08112		

* $p<.05$

Table IV

ANOVA for Probed Recall Measures

	Source	df	Mean Square	F	Tail Prob
(A)	VERSION	1	0.80185	0.98	0.3280
	COVARIATE	1	9.67118	11.81	0.0013*
	ERROR	43	0.81905		
(B)	TOPIC	1	5.11387	10.19	0.0026*
	B X A	1	1.63440	3.26	0.0780
	ERROR	44	0.50190		
(C)	MEASURES	2	5.61566	18.20	0.0000*
	C X A	2	0.30257	0.98	0.3791
	ERROR	88	0.30849		
	B X C	2	1.80439	5.04	0.0084*
	B X C X A	2	0.85389	2.39	0.0979
	ERROR	88	0.35785		

* $p < .05$

Table V

MANOVA for Incidental Oral Free Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.02366	-.91430	.363
(B) Topic	.02365	.87143	.386
A X B	.02365	1.17662	.243

Table VI

MANOVA for Evoked Oral Free Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.02029	-.64252	.522
(B) Topic	.02028	-.15275	.879
A X B	.02028	-.87311	.385

Table VII

MANOVA for Target Oral Free Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.04443	-.78075	.437
(B) Topic	.04440	.09694	.923
A X B	.04440	-3.17930	.002 *

* p .05

Table VIII

MANOVA for Factual Probed Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.05674	.17502	.861
(B) Topic	.05671	.17117	.864
A X B	.05671	-.57985	.564

Table IX

MANOVA for Incidental Factual Probed Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.05470	-1.28621	.202
(B) Topic	.05467	2.04847	.044*
A X B	.05467	2.13237	.036*

* $p<.05$

Table X

MANOVA for Inferential Probed Recall

Source	Std. Err.	T-Value	Sig. of T
(A) Version	.09086	-1.11557	.268
(B) Topic	.09081	3.15664	.002*
A X B	.09081	1.62051	.109

* $p<.05$